



ALL HANDS ON DECK
EUROPEAN WORK HERITAGE IN SHIPWRIGHT FOR PRESENT AND FUTURE
(2019-1-ES01-KA204-065201)

Shipwright Course
(Module 9)
Safety at work

ALL HANDS ON DECK
European work heritage in shipwright for present and future

SAFETY AT WORK

MODULE 9



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MODULE 9 Safety at work

Objectives

At the end of this module, the student will obtain the skills and knowledge to perform their work in a safe and healthful manner

Duration

21 hours.

Outcomes

- Acquiring basic knowledge about safety
- Understand and recognise the use of general collective and individual protective equipment
- Working safety with wood processing machines
- Working safety in the hull
- Working safety inside the boat
- Working safety in a boatyard
- Knowing and establishing the procedure to work with harmful or toxic substances

Training content

Practices

- Identify risks in shipwright job position
- Use of collective measures
- Distinguish the different types of personal protective equipment
- Risk and preventive measures when working with shipwright machines
- How to work safety in the hull
- Access to the interior of a boat
- Machines for lifting out operations
- How to deal with hazardous substances

Theory

- Most common risks in shipwright job position
- Hierarchy of control of risks
- Different collective measures
- Personal protective equipment
- Different shipwright machines
- Working in the hull



- Working inside the boat
- Shipyard
- Lift out operations
- Harmful substances



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Unit 1. Introduction to safety

1.1. Safety in Shipwright profession

Safety is fully connected in the world of work with Risk Prevention which is the discipline that acts by evaluating the work environment (it is being included machines, shifts, hours, workload, chemical pollutants...) and determining to what magnitude they can affect the worker's health in order to minimise their negative effects and create working conditions and methods that are close to the ideal state of physical, mental and social well-being (which is what the WHO has classified as health and not the absence of illness as was traditionally done).

Also, in this field, traditionally, Risk Prevention has always followed a reactive action model, for example, action was taken when the events had already occurred. But the focus was changed, for the worker's benefit, from a restorative approach to a preventive approach, where action is taken before something happens. From this new approach it is needed to foster a preventive culture to minimise accidents and injuries at work and it could be related with an initial assessment of the risks which are present in the working environment, and consequently, where necessary, adopting appropriate measures to eliminate or at least reduce the risks detected.

Workers who are doing different tasks in vessels like shipbuilding or maintenance or repair work are exposed to numerous risks: exposure to extreme temperatures, people falling on the same or different levels, falling or collapsing boats, fire, projection of fragments or particles, being run over by fork-lift trucks, risks due to exposure to physical agents or exposure to chemical agents among others

The process of improving working conditions at a shipbuilding or ship repair facility should be approached in an inclusive and systematic way, taking into all those risks, in order to bring them up to reasonable standards. It is necessary to invest in permanent structures, personal protective equipment and training for their continuous review, planning, implementation, evaluation and action.

It is different the responsibility and tasks for the worker or the employer (in case that both roles are different) because employers have a duty to coordinate, protect and promote the safety and health of all workers, in fact employers should provide and maintain workplaces, equipment, tools and machinery, and should design work so as to eliminate or, if this is not practicable, control hazards and risks in work environment, and be consistent with national laws and regulations. Employers



have to provide, where necessary, adequate protective clothing and protective equipment to prevent, so far as reasonably practicable, risks of accidents or adverse effects on health. Furthermore, they should ensure that workers receive adequate information and training on safety and health regulations, policies, procedures, and requirements and be sure that information is understood. Also, they have to investigate accidents, illnesses and incidents, in cooperation with workers, to identify all causes, and measures necessary to prevent recurrences of similar accidents, illnesses and incidents.

Usually, in this field (shipwright), the role of workers and employer is done by the same person, and they need to apply all these rules in themselves. But, in some cases, it is not, and workers have to cooperate and follow all the given instructions and procedures, including the proper care and use of protective clothing, facilities and equipment placed at their disposal for this purpose, and participate in instruction and training programmes provided and should demonstrate such acquired knowledge and understanding of safety and health measures on the job. Finally, workers have the right to remove themselves and their co-workers in the vicinity from danger resulting from shipwright tasks when they have reasonable justification to believe that there is an imminent and/or serious risk to their safety and health.

Everything of this to achieve a safe, healthy working environment is a crucial factor in an individual's quality of life and avoiding accidents at work which is defined in "European Statistics on Accidents at Work" (is the main data source for EU statistics relating to health and safety at work issues) as a discrete occurrence during the course of work which leads to physical or mental harm. Fatal accidents at work are those that lead to the death of the victim within one year of the accident taking place. Non-fatal accidents at work are defined as those that imply at least four full calendar days of absence from work (they are sometimes also called 'serious accidents at work'). Non-fatal accidents at work may result in a considerable number of working days being lost and often involve considerable harm for the workers concerned and their families. They have the potential to force people, for example, to live with a permanent disability, to leave the labour market, or to change job.

It is important to take into account that an accident at work is always avoidable; thinking that an accident has happened without a cause is totally wrong, because accidents are the consequence and effect of a previous anomalous situation, in which the conditions that made it possible for the accident occur existed previously. Moreover, it is key to consider the incidents where nothings happen to the worker, but it was possible.

Related with this, an important variable to take into account is the real cost of accidents which is very high, more than we often realise, in fact it includes many



more aspects than are usually attributed to them. For that, it is important to allocate the necessary resources for their prevention. Usually in costs we are speaking about direct costs because is what it is paid to remedy as far as possible the consequences of the accident, speaking about personal injury or damage to property (it is included medical expenses, working hours, pharmacy costs... but there are indirect costs which are important like loss of the time of co-workers, machines stopped, lower performance due the moral or damage to the image.

It is clear that it is worthwhile to invest in prevention in work environments, and shipwright it is included in this recommendation. Broadly speaking, in this field, employer or the responsible in the work environment should prepare an initial review by competent persons with the implication of the workers with the following tasks:

- identify the necessary work procedures and the associated hazards;
- assess the risks to safety and health arising from the existing or proposed work environment or work organization;
- identify the current applicable national laws and regulations, national guidelines, specific guidelines, voluntary programmes and other relevant requirements for the activities to be carried out;
- determine whether planned or existing controls are adequate to eliminate hazards or control risks; and
- analyse other available data, in particular data provided from workers' health surveillance, the surveillance of the working environment and active and reactive monitoring, if available.

This review should be used in the systematic development of safety arrangements in shipbuilding and as the basis for the planning and practical implementation of the safety policy.

Moreover, for these kinds of works which by its nature exposes workers to hazardous chemical, physical or biological factors, climatic conditions arrangements should be made for the identification and periodic assessment of these hazards and risks to safety and health at each permanent or temporary workplace in both the facility and every new ship, generated by the use of different operations, tools, machines, equipment and substances. Those data should be used for the development of safe workplans and after that, implement appropriate preventive and protective measures required to prevent those identified hazards and assessed risks, or at least to reduce them to the lowest reasonable and practicable level.

In those preventive and protective measures, it is needed to follow the philosophy of applying, first of all, on the source (eliminating the hazard or controlling), more than in the consequences or in the protective equipment, for



example it could be replaced hazardous equipment or substances for less hazardous equipment or substances. After that, in so far as the risk remains, provide for the use of Personal Protective Equipment, including protective clothing, in various sizes, adaptable to each one.

It is recommended that all of those procedures will be documented, even a process to monitor and evaluate the effectiveness of the activities.

1.2. More common risks in Shipwright

There are several risks that can be considered as more likely to occur in shipwrighting, we are going to mention some of them, and these will be expanded upon in a later section:

- Falls from one level to another
- Slips and trips
- Falling objects due to collapse or landslide
- Fire
- Contact with irritating or corrosive substances
- Exposure to harmful or toxic substances
- Knocks and cuts from objects or work equipment
- Inadequate environmental conditions
- Exposure to biological contaminants
- Electric contacts
- Shocks and impacts against moving objects
- Cuts
- Falling objects during handling
- Projection of fragments or particles
- Collapse of wood stacking
- Entrapment in machinery
- Overexertion due to improper or forced postures
- Repetitive motion overexertion
- Overexertion due to manual handling of loads
- Burns

This is not a closed list but it is important to pay attention to these risks because they occur more frequently in this context.



1.3. Risk identification, assessment, and preventive and protective measures

On the previous subunit, it was mentioned more common risks and it is necessary to apply to the concrete case, trying to identify if some of those risks (and other possible ones) are present in our work environment, for that it has to be analysed the different situations related with working tasks of this job position with the implication of workers and experts. It will be included previous accidents, injuries, illnesses that have occurred in recent years and of which there is evidence. Also, it could be observed the workers in the normal performance of their tasks using their tools and machines, to detect the possible potential risks that they could face. After that, it could be discussed with the workers in order that they could give more information about those possible risks. It will be included an analysis about the design of workplaces, the materials that are used, tools, and how the work is organised.

Once the risks have been identified, they need to be assessed which is a process used to determine the level of risk of injury or illness associated with each identified hazard, for the purpose of control; for that it is included concept of risk rating which it is calculated as follows:

$$\text{Risk Rating} = \text{Probability of Occurrence} \times \text{Severity of Consequences}$$

Probability of occurrence explores the likelihood that an identified risk could occur. Severity of consequences assigns a rating based on the impact of an identified risk to safety, resources, work performance, property, and/or reputation

According to this, the risk assessment process should take account of the likelihood and severity of injury or illness from the identified hazard. This information is important because risks with high probability of occurrence and high severity should be prioritised in their elimination or reduction of both parameters. In that way we will have a list of risks associated a different task and a risk rating according to their probability of occurrence and severity of consequences

Applying appropriate control measures to your highest risks should reduce the probability of occurrence and severity of consequences. It could be followed an order of priority that it is called hierarchy of control with some different steps:



- **Elimination:** try to eliminate it completely, reducing to zero without a shifting it elsewhere. This is a permanent solution and should be attempted in the first instance. If the risk is removed, the rest of the things are no longer needed.

- **Substitution:** means replacing the hazard by one that presents a lower risk. The elimination is immediately combined with a shift to another but much lower risk, for example substitution with a safer form of the same chemical.

- **Engineering Controls:** Engineering controls are physical means that limit the hazard. These include structural changes to the work environment or work processes, erecting a barrier to interrupt the transmission between the worker and the hazard. Priority should be given to measures which protect collectively over individual measures.

- **Administrative Controls:** Also known as organisational measures, administrative controls reduce or eliminate exposure to a hazard by adherence to procedures or instructions. It is necessary to fix all the steps and procedures to do the activity in a safety way.

- **Personal Protective Equipment (PPE):** Even though the hierarchy of control measures indicates that Personal protective equipment is one of the least effective of control measure (because it is better to act at source), it should absolutely be used, PPE is always essential to reduce exposure to hazards when controls are not feasible or effective to reduce these risks to acceptable levels. PPE has the serious limitation that it does not eliminate the hazard at the source and may result in employees being exposed to the hazard if the equipment fails. The success of this control is dependent on the protective equipment being chosen correctly, as well as fitted correctly, always worn and maintained properly.

Unit 2. General collective and individual protective equipment

As it was said, it is better to focus the priority on measures related with collectively protection over individual measures.

Collective protection is the safety technique whose goal is the simultaneous protection of several workers exposed to a certain risk. They should always be considered before individual ones. Not only because they protect many, but also because they don't usually require action by the individuals using them. An example is the systems used against falls from heights (railings, footbridges, safety nets, scaffoldings, grilles, hole coverings...), some of them are used in construction of ships.

Individual protection is a technique that aims at protecting the worker against external aggressions, either physical, chemical or biological, that may arise while developing a working activity. Its goal is not to eliminate the risk of accident, but to



reduce or eliminate the personal consequences or lesion that it may cause. Personal protective equipment (PPE) is protective clothing, helmets, goggles, or other garments or equipment designed to protect the wearer's body from injury or infection.

Often, the best way to control a hazard and reduce risk is through a combination of controls. You don't have to pick one against the other. You can use both types together to give the best level of protection, but make sure that they are compatible with each other and don't introduce other hazards or risks

2.1 Collective measures

The use of collective measures will depend on the particular task and associated risks, they can be put in place once, and control the risk for many. We are going to analyse some of those collective measures:

- Handrails, walkways and stepladders. One of the main risks in shipbuilding is falling from one level to another, moreover if you are working in the hull or you are trying to access to the inside of the ship on a shipyard. Stepladders shall be secured at the top of the ladder to the vessel and shall be fitted with non-slip rubbers at the bottom. They shall be made of solid and strong materials and shall be in good condition and must be in a good state, with no damaged or missing steps. Ascending and descending from any staircase shall be carried out without haste, always facing the ladder, without carrying tools (tool belts shall be used), it is forbidden to jump to the ground from any step.

- Scaffolding. It is totally needed if you are working on the hull, for example caulking. They must be of sufficient height. Scaffolding must be erected and used in accordance with their specific regulations and must be installed by trained and qualified personnel following manufacturer's instructions carefully. It is recommended to have documentation with the detail of the sequence to the safe installation, their use and dismantling. The layout of the platforms and the scaffolding system must be appropriate to the type of work or tasks to be done, the loads to be supported and allow to work on them in safe conditions. They should have stability, for that it is necessary to check the location for possible hazards like sloping or uneven surfaces or any other obstructions. In many cases, the curved form of the hull has not been taken into account in the placement of the scaffolding, for that the gap could very large between the scaffolding and the hull. The use of guardrails is recommended for any platform higher than 1 meter and a half, but this precaution is often not observed which has resulted in falls and serious injuries. If scaffold planks are unsecured, overloaded or in bad condition, they can break or slide which causes



many falls and injuries. Moving a rolling scaffold while workers are still on the platform can be a very dangerous practice and can cause workers to fall or slip, for that, it should be avoided, for that stable and permanent scaffolding is more advisable. Placing excessive weight on a working platform can cause planks to crack or break. Another common problem is when working material overhangs the scaffold platform and causes the platform to tip and slide. All components of a scaffold, including the working platforms and planks, must be carefully inspected before and after use. Check for rust, breakage, cracks, and any warping or deterioration. All workers must be trained to follow appropriate criteria for working at heights. Climbing up and down a scaffolding platform rather than using appropriate equipment like ladders poses another serious risk and has resulted in many falls and injuries. If the scaffolding has not been secured properly, this practice also poses a risk to other workers on the platform.



Image 1. Scaffold in a caulking operations - Source: CETEM

- The use of local exhaust ventilation for reducing worker exposure. In case of positive measurements of harmful or toxic substances, forced ventilation and/or localised extraction systems shall be used. If these measures are not sufficient, respiratory protective equipment with filters appropriate to the pollutant shall be used.

- Physical barrier in machines. In shipwright, many machines are used to work the wood and they have dangerous parts like the saw. For that, they have safeguards to avoid the access to those cutting surfaces. There are a different type of guards and depending the situation, it could be needed two or more types to ensure workers 'safety:



- “Permanently fixed barriers” are permanently fixed physical barriers that are welded or incorporated into the body of the machine for cases in which, during normal operation, maintenance or cleaning, no person would need complete or partial access to the dangerous area. Those system prevent the guard from being moved (removed or opened) without the use of a special tool such as a spanner. Fixed guards should prevent or minimise the possibility of access to danger points and are designed to allow operations such as adjustments, lubrication, or routine maintenance without the need for disassembly

- Movable guards: which are attached to the machine frame or to a nearby fixed element (such as hinges or slide rails) and which can be opened without the use of tools. They must prevent or limit access to danger zones when they are in the closed position and must ensure safety distances. Or, in other cases are interconnected with the power or control system of the machine. The interlock prevents the machinery from operating unless the guard is closed. They cannot be opened until the dangerous parts of the machine have come fully to rest.

Check that the guards are in place and keep them in place unless a repair is to be made in that area or a check is to be made (e.g. of the saws) in which case the machine must be completely stopped and switched off. Even so, it is recommended that the guard or protection device should not be dismantled if it is not essential and, if necessary, only in that area. In the event that you want to check its operation after the repair, you must always put back all the machine's guards beforehand.

- Other physical barriers. Sufficient physical barriers or fences securely fixed in position by means of fasteners or other suitable devices may prevent access to dangerous areas. Any access points through the barrier, for example gates and doors, should be secured with a lock or interlocking system. Also, it is included acoustic barriers to protect persons from noise by the means of a structure enveloping a noise source

- Workplace signs address a variety of problems by informing workers and visitors of potential dangers. These signs must be noticeable, easy to read, and in many cases, comply with OSHA standards for safety signs

- Order and cleanliness. Order and cleanliness are extremely important for safety at work. Lack of organisation is often one of the reasons behind incidents and accidents. Maintaining order requires careful planning of work and activities, teaching employees the correct procedures and ensuring that the agreed procedures are followed in practice.



2.2 Personal protective equipment (PPE)

Only where adequate protection against exposure to hazardous ambient factors through the elimination of hazards/risks, their control at source, minimization by the design of safe work systems and collective measures cannot be ensured suitable PPE and protective clothing should be mandatory. PPE and protective clothing should comply with technical standards set by the competent authority, or recognized by national or international bodies, taking ergonomic principles into account, and be provided, as prescribed by national laws and regulations. The employer shall provide and shall ensure that each affected employee uses the appropriate personal protective equipment (PPE) for the eyes, face, head, extremities, torso, and respiratory system, including protective clothing, protective shields, protective barriers, personal fall protection equipment, and lifesaving equipment, meeting the applicable provisions of this, wherever employees are exposed to work activity hazards that require the use of PPE.

A competent person having a full understanding of the nature of the hazard and the type, range and performance of the protection required should arrange that PPE and protective clothing are properly stored, maintained, cleaned, examined, replaced and, if necessary for health reasons, disinfected or sterilized at suitable intervals.

Workers should have appropriate instructions and means to enable them to use, maintain and store. They must use throughout the time they are exposed to the risk.

- Eye and face protection. Clear or coloured goggles, a screen, a face shield or other suitable device should be worn when there is likely exposure to eye or face injury from airborne dust or flying particles, dangerous substances, acid or caustic liquids, harmful heat, light or other radiation, and in particular during welding, flame-cutting, grinding or other hazardous work. Face and eye protectors are available in a wide variety of designs. Careful consideration should be given to the characteristics of the respective hazard to ensure the selection of the appropriate protector.

Before using the protectors, they should be visually inspected to ensure that they are in good condition. If there are any damaged or deteriorated part, they should be replaced and, if this is not possible, the complete equipment should be taken out of use. Indicators of deterioration may include yellowing of the eyepieces, surface scratches on the eyepieces...

- Hand and foot protection. Hands and feet should be protected against physical, chemical and other hazards. Protective gloves or gauntlets, appropriate barrier creams and suitable protective clothing to protect hands or the whole body, as required, should be worn when exposed to heat radiation or while handling hot, hazardous, or other substances which might cause injury to the skin or when it is



possible the skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns, harmful temperature extremes, and sharp objects. Footwear of an appropriate type should be employed in workplaces where there is the likelihood of exposure to adverse conditions or of injury from falling or crushing objects, hot or hazardous substances, sharp-edged tools or nails or other objects which could pierce the sole and slippery wet surfaces. Appropriate safety footwear, such as shoes and boots, should have firm, slip-resistant soles and reinforced toecaps and should be always worn properly. Sandals and similar footwear should not be worn when working. Hand and foot protection should be available in appropriate sizes. Knee protectors may be necessary, especially where work involves kneeling. It is often the case with many tasks in shipwright such as caulking

- Head protection. It is recommended to wear safety helmets or hard hats by all persons while they are in the shipbuilding area to protect the head from injury due to falling or flying objects, or due to striking against objects or structures. In general, the shell of a helmet should be of one-piece construction, with an adjustable cradle inside to support the helmet on the wearer's head. Any helmet that has been submitted to a heavy blow, even if there are no evident signs of damage, should be discarded and also if splits or cracks appear, or if a helmet shows signs of ageing or deterioration. The helmet should be as light as possible, the harness should be flexible and should not irritate or injure the wearer

- Hearing protection. Workers who by the nature of their duties are exposed to high levels of noise should be provided with, and should wear, ear protectors. For example, using noisy machines. Hearing protectors reduce the noise exposure level and the risk of hearing loss when worn correctly. The effectiveness of hearing protection is reduced greatly if the hearing protectors do not fit properly, are not inserted or worn correctly, if they are worn only periodically, or if they are removed even for a short period of time. To maintain their effectiveness, the hearing protection should not be modified. Radio/music earphones or headsets are not substitutes for hearing protectors and should not be worn where hearing protectors are required to protect against exposure to noise. There are different possibilities according to the necessities; Earplugs are inserted in the ear canal. They may be premolded (preformed), moldable, rolldown foam, push-to-fit, or custom molded. Disposable, reusable and custom earplugs are available. Semi-insert earplugs which consist of two earplugs held over the ends of the ear canal by a rigid headband. Earmuffs consist of sound-attenuating material and soft ear cushions that fit around the ear and hard outer cups. They are held together by a head band.

- Respiratory protective equipment. Respiratory protective equipment, suitable for the particular environment, should be used when workers cannot be



protected against airborne dust, fumes, vapours or gases by ventilation or other means. Workers should be trained in the proper selection of filters, where appropriate. In some cases a mask with a physical filter adapted to the type of wood would be enough. Appropriate respiratory protective equipment should be used for work in conditions where there is a risk of oxygen deficiency or exposure to poisonous, dangerous or irritating fumes, dust or gases. The face piece incorporated in respirators and breathing apparatus must be fitted correctly to prevent leakage. Each respirator should be used with an understanding of its limitations based on a number of factors, such as the level and duration of exposure, the characteristics of the chemical and the service life of a respirator.

- Protection from falls. Fall protection equipment, attached to independent lifelines or suitable anchorages should be worn where protection against falls cannot be provided by other appropriate means; and life vests and life preservers where there is a danger of falling into water. It is necessary to be trained in the use of appropriate fall protection equipment, such as harnesses and lifelines and, where necessary, shock-absorbing lanyards. Workplaces and roadways in which there are fall hazards or which border on a danger zone should be equipped with devices which prevent workers from falling into or entering the danger zone.

PPE can provide a false sense of security, in particular when it is not properly used or has lost its effectiveness as a result of improper storage or maintenance

Unit 3. Working with wood processing machines

In some boatyards, there is a shipwright area with a variety of machines to work with wood. There are different ones, similar to those that can be found in a furniture factory, the most usual are circular saw, sliding table saw, planer, band saw, mitre saw, thickness machine and routing machine / shaper

These machines must have CE marking machinery (Directive 2006/42/EC), a Declaration of Conformity (formal declaration by a manufacturer, or the manufacturer's representative, that the product to which it applies meets all relevant requirements of all product safety directives applicable to that product and the relevant legislation with which the product complies). It is common for these workshops to have antique machinery, and usually they have an emergency stop; however, they do not have other safeguards that should be in place, such as retractable guards in the case of band saws, or such guards have been removed for some reason.

Main risks to be faced when using machines and preventive measures:



- Cuts or trapping with moving parts. It is possible that some parts of the machines (mainly saws) could cut the worker or he/she could be trapped with some active parts of the machinery.

Preventive measures:

- Workers must wear close-fitting clothing to prevent entrapment, and under no circumstances should they wear bracelets, necklaces, wide sleeves or other dangling elements that could lead to entanglement with the machinery and subsequent entrapment.
- Machinery must be marked to warn of the different risks that have not been controlled.
- Machines that are not working properly or that are damaged in any of their parts must not be used until they have been repaired by qualified personnel.
- Under no circumstances it could be removed any of the protections and safeguards of the machine, independent of the reason (for example for working faster which is common). If the risks persist, even with the machine's guards, and there is a risk of particle projection, the personal protective equipment must be used as determined in accordance with the risk assessment.

Safeguards on machinery

As stated in a previous section (this is complementary to that point). A guard is a means of protection which prevents or hinders access to the danger point or danger zone of a machine. Particularly to sawing areas, protecting with a material barrier. Depending on its form, it could have different names. Provided that the machinery or tool to be used is CE marked or complies with current regulations, these guards must always be placed in accordance with the manufacturer's instructions. These guards may be fixed, mobile or adjustable.

In any case, the guards must comply with some general requirements:

- 1- Be strong and robust.
- 2- Not give rise to additional hazards.
- 3- Not easy to inactivate them
- 4- Be located at a sufficient distance from the danger zone.
- 5- Do not restrict observation of the working area more than is essential.
- 6- Allow only those interventions which are essential for the installation and/or replacement of tools and for maintenance work, limiting access to the area where the work is doing it, if possible, without removing the safeguard.
- 7- To retain projections (fragments, splinters, dust, etc.), whether from the machine itself or from the material being worked on.

All these guards must be kept in good condition, they must not be removed for any reason, they must be checked periodically and in the event of detecting any deficiency in the protection, they must be left out of use until they are repaired.



Image 2. Safeguard in a wood industry machinery- Source: CETEM

- Noise. Produced by the different machinery in the workshop.
Preventive measures: as it is mentioned in a previous paragraph, workers who by the nature of their duties are exposed to high levels of noise should be provided with, and should wear, ear protectors. Hearing protectors reduce the noise exposure level and the risk of hearing loss when worn correctly.

- Exposure to wood dusts. Two types of wood are distinguished: softwood and hardwood. Hardwood dust is classified as carcinogenic.
Preventive measures: All cutting machinery should have localised extraction, and if the risk is still not controlled, workers must be fitted with respiratory protection.
Preventive measures. The riverside carpentry shall be cleaned periodically and whenever necessary to maintain order and cleanliness.
Materials shall not be stored in passageways, but on shelves and in places specially designed for this purpose. Particular care shall be taken not to leave tools or waste in the escape routes.

- Falls in the same level. Mainly due to lack of order and cleanliness or poor lighting.
Preventive measures. The machine and the working place around it shall be cleaned periodically and whenever necessary to maintain order and cleanliness.
Materials shall not be stored in passageways, but on shelves and in places specially designed for this purpose. Particular care shall be taken not to leave tools in the escape routes. Emergency escape routes must be kept clear of obstacles so that they can be used without difficulty at all times. They must not be used for the temporary or permanent storage of any objects or materials.



The lighting in the machine and working place should be adequate. It is recommended, at least, a minimum lighting level of 50 lux.

- Hit with immobile objects. Due to the presence of objects in the passage or access areas to the machinery, or due to the presence of machinery too close to walls or other machinery.

Preventive measures. Workplace must be kept very tidy, and objects must not be left in passageways or access areas to machinery. The separation between the machines will be sufficient for workers to do their work in conditions of safety, health and well-being.

- Electrical risk. Direct or indirect electrical contacts due to the use of machines and work equipment that work with electricity.

Preventive measures. It is necessary to do periodic inspections of the electrical installation, in accordance with the corresponding technical standards. Proper running of the earth electrode and the differential will be checked regularly.

Also, electrical connections need to be checked, and those that are deteriorated or poorly protected should be replaced. Duct tape shall not be used to repair conduits that have lost their insulation.

- Fire and explosion. Due to the presence of flammable solids (wood, sawdust...) or flammable liquids.

Preventive measures: The company must have an emergency action plan in case of fire.

Moreover, only the amount of flammable or combustible materials for the day's work should be available. The rest should be in storage.

Equipment, apparatus and machines must have explosion-proof systems (light points, motors, extractors, etc.) or operate with low voltages (24v).

The working environment must be kept clean of dust in suspension by means of localised extraction and channelled through hermetic ducts.

The provision of extinguishing equipment in the workplace must comply with the provisions of the specific regulations and the access to them must be free of obstacles, and signposted and revised.

- Overexertion. Due to the manual handling of wood to be used with the machines, either by handling excessive loads or by handling loads following an incorrect procedure.

Preventive measures. As a general rule, in order to avoid overstrain due to manual handling of loads, whenever possible, loads should be handled by mechanical means (forklift trucks, pallet trucks, hoists, etc.).



Image 3. Hand pallet truck - Source: CETEM

Regarding the specific machines that can be found in a shipwright's workshop:

3.1 Circular saw

Machine designed for cutting all types of wood.

It basically consists of a fixed table with a groove in its upper part through which the cutting disc passes. This is working with a motor located in the lower part of the machine. Parts can be cut manually by pushing and sliding on the table towards the feed point, or mechanically with a surface which pushes the workpiece to the cutting point.

The products of a circular saw are always flat surfaces since the defining element of the saw is a plane. The position of the guide can be adjusted in relation to the saw, according to the desired size, dividing the wood into boards. The table can be raised and lowered and even tilted so as not to allow the blade to protrude more than the portion necessary for the cut. The operator always stands next to the saw shaft and to the left.

It is a dangerous machine, where historically there have been numerous accidents. The most common risks associated with this machine are direct contact with the saw (nowadays there are safety systems that stop the saw when it comes into contact with a soft surface (like a finger) or any object that conducts the electric current and lowers it in milliseconds, thus preventing of cutting); contact with the transmission belts; recoil of the piece to be cut; projection of the blade or part of it;



noise; inhalation of wood dust; forced postures and overexertion. We have mentioned preventive measures of those risks.



Image 4. Circular saw - Source: CETEM

3.2 Sliding table saw

This is a machine with manual feed of the workpiece, equipped with a circular saw blade which is fixed during the cutting operation, and an integrated sliding table adjacent to the saw blade, which can be equipped with a scoring blade for cutting postformed edges. Its use includes linear miter cuts 90° of wood boards and panels.

The main risks are caused by cuts, projection of particles, entrapment by or between objects and inhalation of wood dust.

It must be noted that all hand-held controls must be located at a height of 600 mm or more above ground level. Attention must be paid to the safeguards that must be allocated in the machine:

- 1- The part of the blade inferior to the table must be installed within a dust hood which incorporates a hose for the extraction of chips.
- 2- For machines with a maximum cutting capacity of more than 50 mm, the upper guard of the cutting saw must be fitted with an extraction port.



Image 5. Sliding table saw - Source: CETEM

3.3 Planer

Planers are machines that are used to work in a wooden surface to make it smooth and without warping.

This machine consists of a frame that supports the working surface, which comprises two horizontal tables (infeed and outfeed table), between which the cutterhead knives are allocated.

The main risks are caused by contact with the cutting tools, hits and/or contusions due to the unexpected and violent recoil of the workpiece, projection of cutting pieces or other accessories in movement, noise, inhalation of wood dust and maintained forced postures.

For that, it is important to protect the moving parts of the machine and periodically check the sharpness and balance of the blades, they must always have the same weight. The wood must be handled in such a way as to prevent the operator's hands, which guide and push the piece, from coming into contact with the saws. For this purpose, it is advisable to place the left hand on the front end of the piece, pressing it against the table, keeping the fingers closed; the right hand placed on the back end of the piece will push it forward.



Image 6. Planer - Source: CETEM

3.4 Band saw

The band saw term derives from its cut tool, which is a steel band in the form of an endless saw blade. This band moves thanks to two wheels allocated in the same vertical plane, one above the other. The main functions of this machine are the bucking of rough lumber boards in their cross-section, longitudinal cutting to obtain strips and cutting of pieces following a pattern. It could be fed in a manual or automatic way.

Main risks are caused by the possibility that the band could fall due to insufficient tension or poor adherence of the band to the machine, violent breakage of the band with projection due to excessive tension of it (this tension is generally determined by an incorrect assembly and adjustment of the blade), contact of a part of the body with the blade in the area of operation (mainly the hands) due to a bad position of the operator's hands or different resistances of the wood that make changes in the penetration (this is a really important risk with bad consequences for the operator), contact with other moving parts, noise, inhalation of wood dust, forced postures and overexertion.

It is really important to take into account the safeguards that the machine must have: for example self-adjusting guard, side screen guard, adjustable guard, guard with manual adjustment of the operating point. It is forbidden to remove these guards under any circumstances.

3.5 Mitre saw

This tool is used to cut wood at a specific angle between 45° left or right to the normal plane of contact of the blade with the wood. Bevel cut is possible as well. To

operate with wood, the operator places the piece on the table against the fence, selects a cutting angle and moves the disc arm closer to the piece. There are miter saws with two heads that can work at the same time.

Main risks are caused by inhalation of wood dust, cuts with the blade, entrapment by moving objects and excessive noise.

To prevent this, the access to the areas of the blade which are not being used for cutting must be prevented by a fixed barrier. Where access is required to change the saw blades, the guard must be capable of being opened only with the use of a special tool. It shall be provided with a device for automatic locking of the blade in the standby position, with a trigger on the handle of the operating handle which must be pressed before the blade is lowered to release the locking device. In the case of machines with the possibility of cutting from the top, they must have protection in this area, consisting of a disk guard and dividing knife to prevent contact with the back part of the blade or the projection of the workpiece during cutting.



Image 7. Miter saw - Source: CETEM

3.6 Thickness machine

The thickness planer is used to obtain a flat surface parallel to another previously prepared surface and at a predetermined distance from it. When the planing is finished, this machine leaves it at the desired thickness and width. It is comprised by a single piece base, which supports the table, the cutterhead knives and the transport and adjustment devices.



In the thickening machine, the operator first adjusts the table according to the thickness of the workpieces, then stands to the left of the machine in front of the handle which drives the mechanism for the workpiece to pass through the roller, this can be helped by the operator pushing the workpiece before start cutting. While the machine is working the wood, the operator moves to the opposite side to receive it.

The thicknesser is one of the least dangerous machines in the furniture field used to machine wood because the operator does not have to manually approach the workpiece towards the cutting tool while is working.

This machine has acceptable safety conditions, as its dangerous parts are completely enclosed and one of the main risks of this machine, which is the violent recoil of the workpiece, is also protected.



Image 8. Thickness machine - Source: CETEM

3.7 Spindle moulder

It is used to modify the profiles of wooden parts, creating grooves, mouldings, etc., by means of the action of a cutting tool that rotates on a normally vertical axis, although in certain cases it can be horizontal.

This machine is distinguished by its versatility. For each type of work, the most suitable speed is chosen depending on the cutting tool (which is chosen according to the type of cut that we want to make), the wood that we are using, the depth of the cut, etc.



Manual feed routing machines are provided with a monobloc or a detachable fixed vertical tool bore, which is in a fixed position during operation, and a horizontal table, in which all the elements are fixed during operation.

This machine is traditionally considered one of the most dangerous ones and has even been officially included in the lists of dangerous machinery. The main risks are caused by violent recoil of the workpiece due to a variation in resistance caused by knots, hits and/or contusions, and contact with the cutting tool (maybe the main risk), projection of the cutting tool, noise, inhalation of wood dust, forced postures and overexertion.

The moving parts of the machine must be protected. Operations with this machine must be done with the tool below the workpiece. The workpiece must be fed in the opposite direction to the rotation of the tool, in all operations where possible, in order to hold the workpiece better, because in this way there are less possibilities that the piece would be thrown out and, if this happen, there is a more chance that the worker's hands would not move towards the cutting tool. It is crucial not working with rush in this machine and do not force the machine to higher operating speeds by applying inappropriate pressure on the workpieces to be cut.



Image 9. Spindle moulder - Source: CETEM

Unit 4. Working in the hull

The watertight body of a ship or a boat is called its hull. The hull may open at the top, or it may be fully or partially covered with a deck. Atop the deck may be a deckhouse and other superstructures, such as a funnel, derrick, or mast. The line where the hull meets the water surface is called the waterline. here is a wide variety



of hull types that are chosen for suitability for different usages. In a typical wooden sailboat, the hull is constructed of wooden planking, supported by transverse frames (often referred to as ribs) and bulkheads, which are further tied together by longitudinal stringers or ceiling. Often but not always there is a centerline longitudinal member called a keel.

Hulls under construction should be so fixed as to be incapable of overturning. The safety factor against tipping should be at least 1.5. For that it is necessary to take measures to ensure the stability:

- A supporting base of adequate strength.
- Underlying structures of sufficient strength and stability.
- Supports for the hull.
- Stays on the outside of the hull.
- Anchoring.

If there is any danger that the stability of the hull will be affected as work proceeds, stability should be ensured at each stage by suitable measures. No structures supporting the vessel and no part of the hull, should be dismantled or removed without a deep analysis. Supports, stays and anchors should be properly secured against sliding, overturning, falling down and buckling.

No load-bearing member of the structure shall be dangerously weakened by cuts, holes, or other means. Before cutting or drilling holes in floors, decks or bulkheads, workers on the other side of such structures shall be informed of the risk.

Working on the hull, usually, it could be necessary, initially, to work assembling pieces, and it is mandatory not carrying on the assembly work in passageways, and it is needed to be provided a space or place of adequate dimensions to storage finished sections and equipped with transport and lifting appliances that ensure an easy and safe installation, storage, and removal of the sections. It should be stored in a secure position. Before being used and placed in the ship, those prefabricated sections should be completely finished and ready for placing in position and provided with adequately dimensioned and placed attachments and with the necessary indications for placing them.

If you or your workers are working on the hull it is necessary to take into account, the peculiarities of the workplace about risks and safety conditions according to the tasks that it is doing on the hull (it could be the construction of different types or maintenance).

Some of the risks are the following, and it is necessary to check it and take the adequate measures to remove it or reduce it:



- Fall of persons to a different level, due to work with ladders. Ladders shall always be used for access to the vessel and not for working on the hull of the vessel, it could not be working in those ladders, it is only for using to access to the hull, it is mandatory to use a safer surface. In spite of this recommendation, it is common that it is used these ladders as working surface which is strongly discouraged because of the risk of falling out of them.

- Fall of persons to different levels, due to work from scaffolding or mobile lifting platforms with different tasks. It was mentioned in a previous section, speaking about collective measures, how to work with scaffolds in ships. It is essential to respect the instructions of the manufacturer in relation to the assembly, installation, use and maintenance of the scaffolding. Those scaffolds need to have sufficient height. It is important to have guardrails and internal ladders and checking that scaffold has no defects, if the person who are using it, observes any defect, must immediately inform the person in charge of erecting the scaffolding.

It is necessary to plan the work to be carried out and the access to the vessel before scaffolding. For this reason, the places where it will be located must be defined before starting the work. The layout of the platforms must be appropriate to the type of work to be carried out, the loads to be supported and allow work to be carried out on them in safe conditions. It is important to remark that all work carried out at heights on scaffolding shall be carried out on working platforms of sufficient strength and stability and it is needed to take into account the curved shape of the hull to be placed, in every case, it will be analysed the gap between the hull of the ship and the scaffolding, and in case of long distance (more than 30 cm) it will be added a guardrail in the inner side (on the side next to the vessel), in case that this guardrail has to be removed due to work circumstances, worker must wear personal protective equipment against falls with an anchorage to a fixed point, and replace the guardrail as soon as the work that necessitated its removal is completed.

Also, it is possible to use mobile lifting platforms but, it is needed to accomplish some security measures and receive training for using it. Besides that, it is needed to check possible defects or faults that may affect safety, in accordance with the manufacturer's instructions, especially in the following points:

- Operational and emergency controls
- Safety devices
- Availability of personal protective equipment against falls
- Warnings and control signals
- Physical condition of the structure
- Abnormal condition of wheels, brakes, and batteries



- Existence of residues, mud, oil, paint... that could make the surface of the work cage slippery.

Working platform must be equipped with handrails or any other structure around its entire perimeter and must have protection that prevents people from sliding or falling underneath them or objects falling on them. The access door to the platform must be lowered or closed before operating the equipment. It is compulsory not attaching any elements to them (including ladders, planks or scaffolding) in order to reach greater heights and not overloading. Workers must use harnesses anchored to specific points provided for this purpose. They must always remain inside the work basket, with their feet on the floor of the basket, and it is forbidden to sit or climb on the guard rails.

It is a clear risk that the mobile lifting platforms could overturn and for that, it is really important to take into account that the surface besides the platform would not be tilted or muddy. Moreover, not using in bad weather conditions (wind, strong rain) and do not exceed the maximum permissible number of persons on the platform.

- Falling of objects. Due to the presence of other workers in areas where work is being carried out with scaffolding or mobile lifting platforms. Work area must be delimited to prevent people not involved in the work from staying or circulating in the vicinity.

- Overexertion. Due to manual handling of loads, either by handling excessive loads or following an incorrect procedure. For that, whenever possible, loads should be handled using mechanical means.

- Vibration. Mainly hand-arm, due to the use of hand tools such as sanding machines. For that, it is recommended to select tools with lower vibration emission, according to the manufacturer's declaration, as well as the use of these tools for the purpose for which they were designed. Also, it is recommended to reduce exposure time by reducing tasks, scheduled breaks, proper health surveillance

- Exposure to harmful or toxic substances (for example for painting the hull). It is recommended to have the safety data sheet of all chemical products used, which must be correctly labelled in accordance with the regulation. In any case, it has to be done an assessment in the worker's breathing zone and their subsequent comparison with the corresponding environmental limit value. Depending on the results of the measurements carried out, the corresponding measures shall be taken. If necessary, depending on the results of the measurements, forced ventilation and/or localised extraction systems must be used. Finally, if these measures are not sufficient, respiratory protection equipment with filters suitable for the pollutant must be used.



Unit 5. Working inside the boat

5.1 Access to the interior of the boat

First of all, it is important to take into account the way to access to the vessel. Adequate and safe means of access and egress should be provided for all workplaces during all shipbuilding and ship repair operations. The places where the access will be located must be defined before starting the work.

Those means of access should be maintained in a safe condition:

- where practical, the ship's accommodation ladder, a gangway, a service tower, construction elevator or similar appliance
- in other cases, ladders, stairs, or, if necessary, adequate stepladders or similar appliances
- approved lifting cages.

If it is used portable stairs to some sections, they should be equipped with handrails and mid-rails if the height is above 1 metre.

Risks to be taken into account, when securing access to the ship, are very varied:

- Falling from different levels. If the access is with ladders (in occasions with hand ladders), they should have sufficient height, do not have to be inclined and they have to be strong and stable. Ladders must be fastened at the top to the boat and must have non-slip rubbers at the bottom. They must be placed at an angle of 75 degrees to the horizontal. Ladders must be made of solid, resistant materials and must be in a good state of repair, with no damaged or missing steps. Ascending and descending shall be done without haste, always facing the ladder, without carrying loads (tool belts could be used), and no step shall be jumped from any ladder to the ground. They should be free of mud, oils, grease, cables, tools or other slippery substances or substances that could cause accidents. Worker must wear footwear with non-slip soles. Ladders shall always be used for access to the vessel and not for working.

- Falling of objects or tools Objects or tools on people located under the access ladders to the boats. For that, no workers shall be located under the ladders to access the vessels and it would be secured against falling objects.

Considering those risks, means of access should be:

- kept free from obstructions
- protected against falling objects if they pass under workplaces



- as far as practicable, so installed that no loads pass over them. In any event, loads should not be passed over the means of access while workers are on it.

Hatches, openings or any other means of access to holds, ships' decks or between decks should be provided with safety barriers. If it is not practicable to provide fixed hold ladders, portable metal ladders or appropriate wooden ones should be provided. All ladders should be secured before being used.

It will be provided adequate lighting to avoid risks and avoid that the way of access being too rigged. Maintenance is a crucial part when ensuring a safe access, for that, it is recommended regular inspections of welds, distortion, cracks and corrosion, and also that moving parts are greased appropriately or the underside of gangways and accommodation ladders.

5.2 Inside the boat

Once inside the vessel, for the proper performance of the various tasks, there are some risks to be controlled and the recommended preventive measures, important to be focused mainly on confined spaces:

- Falling at the same level. Due to poor lighting or due the presence of substances such as grease, oil, tools or other materials. For that, a clear measure is to improve the lighting inside the boat, this would be adequate, especially at times of the day when natural light is not possible. Moreover, the floors of the boat must be kept in a clean and tidy condition, for that, no tools, substances, or other materials should be left behind. Spills of grease, oil, rest of paint or any other slippery substance must be collected immediately and by appropriate means. Workers shall wear footwear with non-slip soles. Special care shall be taken not to leave tools, equipment, cables in passageways.

- Falling to other level. Inside boats there may be unprotected hatches or holes through which workers could fall. Also, they could fall on the ladders and stairs inside the vessel, as they could be in a poor state of repair. To prevent that it is essential to have adequate protective measures on hatches and other deck openings, which should be kept closed while is working inside, also it is important to keep internal ladders and stairways in a good state.

- Bump or hit with static objects which are in passageways or moving objects that fall down. For that, recommendation is to be extremely tidy and do not leave objects in the transit areas and avoid the presence of workers below the area of working.



- Musculoskeletal disorders because the adoption of forced postures and repetitive movements, sometimes for prolonged periods of time, due in part to the reduced working spaces as well as the use of the tools that it is needed to be used. For that, the working space should be sufficient to allow tasks to be carried out with correct movements and working postures and to allow for postural changes. If, for reasons inherent to the task, the space available does not allow the worker the freedom of movement necessary, it is recommended to do as much of the task as possible in a larger space and then try to adapt it to the corresponding place in the shortest possible time; also, organisational measures, such as task rotation, regular breaks can be used. Moreover, breaks should be taken to avoid prolonged periods of working on the knees. In addition, the use of kneepads is recommended.

- Asphyxiation and poisoning due cleaning or painting tasks because poor ventilation. Every effort should be made to substitute hazardous substances, especially carcinogens, mutagens and reproductive toxicity, used in painting operations. Moreover, adequate ventilation, whether general or local, should be provided; and in some cases, if necessary to prevent danger, workers should wear respiratory protective equipment that operates independently of the surrounding atmosphere. When paint is being applied in parts of the interior of a vessel, no other work should be carried out in such parts, either during that time or for a certain period afterwards, until it is safe.

- Possible fire or explosions inside. This is really dangerous for the safety of the workers, for that, before commencing work, measurements of flammable substances must be taken and check that there are not sources of ignition. Moreover, it is necessary that fire-fighting equipment must be available in the immediate vicinity of the work area, and worker need to have the training to know how to use it according to the different types of fire. Experts recommend storing fire extinguishers in an upright position and mounted in an easily accessible place. They could be allocated in rooms where fires are more likely to break out such as the hull, cabin, kitchen and bilge.

Finally, it is worth mentioning that every boat must have an escape route, which must be kept clear of obstructions so that it can be used without difficulty in case of emergency accomplishing the rule of not used for the permanent or temporary storage of any objects or materials, and it has to be adequately signed.



Unit 6. Working in a boatyard

A shipyard or boatyard is a facility for building, maintaining, and repairing ships and boats which can vary in size from personal sailing boats to large container ships. Numerous people work in a shipyard, for example shipwrights but there are other people like naval architects, engineers, electricians, and an assortment of other skilled tradespeople who contribute to the construction of a ship. Also, there are different types of shipyards, for example for civilian or military task; public shipyards in a large port or much smaller private shipyards where are working less people in less vessels. A shipyard also has a large amount of specialized equipment.

In general, in the shipyard is built the ship from the ground up, creating the hull and configuring the interior of the ship to the specifications before launching it and fitting the ship out. The shipwright plays a major role in this process if we speak about wooden crafts, although he works, often, in collaboration with other professionals.

Inside a shipyard, there are a large amount of specialized equipment, work places or machines, like assortment of cranes for lifting ship components or large land-based slips to lay the keels for their ships, and to build up the hulls, along with enclosed dust free environments and areas set aside for painting. Moreover, it is usual that multiple ships are built at the same time in different stages of completion or repair.

The diversity of tasks that it could be done in a shipyard means that a wide range of risks can occur. For example, in the case of repairing wooden boats, tasks of lifting out of the water, either with a travel-lift or with other type of crane, mainly involve the risk of the boat collapsing, while the lifting out operation or when depositing the boat on the various supports. It will be analysed these risks deeper.

Other risks that it could be faced while you are working in a boatyard:

- Falling to different levels, due to access to the vessels, is one of the main risks that can occur during repairing tasks or even constructing ones, as well as the fall of people to the same level due to the use of water for cleaning the hull in maintenance tasks.

- Risks arising from the use of forklift are also very important in this type of activity: entrapment due to the forklift overturning, falling of objects, collision, etc.



- Use of paints for the hull and decks of the vessel means that the risks derived from the use and storage of chemical products, such as exposure to solvents or fires due to inadequate storage of flammable substances, must be taken into account in a boatyard

- Risks with and saws, milling machines and other machinery typical of carpentry workshops because shipwright has to work with those machines (it was analysed in a previous section). In this case, it need to be taken into account that these are machines with a very long service life, it may happen that those existing in the carpentry workshops are old machines, without CE marking, without declaration of conformity and without instruction manuals. It is therefore not uncommon to find machines with no guard, no emergency stop and with significant cutting and trapping risks.

- Physical hazards are also present, such as the noise produced by the machinery, it is important to minimize that noise. Also, the temperature could be an important risk, and it is necessary to avoid being harmed by extreme heat or cold. It is important that the worker understand how extreme temperatures can negatively affect them and how they can protect themselves in such conditions. In case of extreme heat, when our bodies get overheated, they lose the ability to keep functioning. The main problem is water and salt depletion. We lose both when we sweat, and if either gets too low, our bodies can't cool themselves down. The longer their bodies struggle to stay cool, the more their health are put at risk. Even it could even result in a heatstroke. It is necessary to reduce the risk of working in extreme heat with different possibilities:

- If it is possible remove the source of heat (if it is a machine) or replace it for other one that produces less heat

- Moving working areas to colder locations

- Install ventilation or air-conditioning

- Provide protection from the sun if working outdoors

- Schedule work for cooler times of the day or year (if it is possible)

- Allow extra breaks to cool down (away from the heat), or rotate tasks

between workers where conditions are hot

- Having lots of cool drinking water and drinking it avoiding caffeine, energy drinks, and alcohol.

- Monitor the work environment (such as temperature or humidity levels) to make sure that safe levels are not exceeded

- Being protected from the sun with something for the head and plenty of sunscreen

- Stop working if the work environment has become unsafe to continue working in, or if it is noticed signs of heat-related illness or injury.



Also it is dangerous to work in extreme cold conditions. Human bodies' only natural defense to extreme cold is to shiver (to generate heat from our muscles) and to constrict our blood vessels to limit blood flow to the skin and extremities (reducing heat loss). Neither of these responses provides much protection and, if anyone are exposed to extreme cold for too long, the risk of suffering health consequences is very high. These consequences include frostnip in fingers, toes, ears or nose, frostbite or hypothermia (even a temperature drop of a degree or two can be serious. Hypothermia causes numbness, a loss in dexterity, and confusion). In instances of frostnip, covering the extremity is often enough to solve the problem, although retreating to a heated environment is an even better solution. For frostbite, seek a heated environment immediately. Mild frostbite is painful but will resolve as the body warms and then heals. Deep frostbite is generally irreversible and often leads to amputation. In all cases of frostbite, it is better to seek medical attention. In the event of hypothermia, it is better to go to a hospital. It is necessary to reduce the risk of working in extreme cold with different possibilities:

- If it is possible remove the source of cold (if it is a machine) or replace it for other one that is designed with protection against cold injury
- Moving working areas to warmer locations and provide shelter from cold draughts, wind, and water
- Schedule work for warmer times of the day or year
- Allow extra breaks to warm up (away from wind and rain), or rotate tasks between workers where there are cold conditions
- Use Protective clothing that protects from cold, wind, and water
- Monitor the work environment (such as air temperature or wind chill) to make sure that safe levels are not exceeded
- Worker should keep as dry as possible and take off damp clothing and personal protective equipment (PPE) before breaks and let it dry before putting it back on.
- Drink a lot of fluids avoiding caffeine, energy drinks and alcohol.
- Stop working if the work environment has become unsafe to continue working in, or if it is noticed signs of cold-related illness or injury

- Risks arising from the use and storage of chemicals in the hull or in the deck, such as exposure to solvents or fires due to improper storage of flammable substances.

- Connected with the previous one, fire represents the greatest threat to any vessel under construction and the shipyard where it is being built. The faster a fire can be identified and fought; the less damage will result.

Ideally, fire fighting systems should have more than one water source. Some shipyards have their own fire stations, complete with fire trucks and trained



personnel. Ideally, the fire trucks should have the capability of taking an independent suction from the sea. But having fire trucks is only available in big shipyards.

Fire mains have hydrants placed at intervals along their length. The hydrants can either be used to feed hoses for use against fires ashore or in workshops or can be used to supply manifolds on board a ship. Maintaining pressurized fire hoses with ample water supplies on board the vessel enables the workforce to respond to a fire rapidly.

It is necessary to have fire extinguishers to provide a prompt response to small, localized fires.

- Asphyxia or ignition. Shipbuilding involves creating and working in enclosed spaces, even in a shipyard. Where natural ventilation is limited or non-existent, forced ventilation must be provided to ensure that spaces are safe for men and for hot work when it is required. The determination of whether or not a space is safe is not based on guesswork; there are standards which must be applied to make this determination. The accumulation of flammable or toxic gases in a space can lead to asphyxiated workers or, in the presence of an ignition source, an explosion. Regular monitoring in accordance with established procedures can prevent such losses

Finally, it is worth mentioning that when infrastructure is properly maintained, materials are stored in an orderly manner, and waste is regularly and properly disposed of, a safe and healthy work environment results. This in turn leads to a more productive, quality-oriented workforce. A key indicator of good housekeeping is the storage and handling of hazardous materials and waste.

Additionally, there may be several professionals working at the same time and also on several vessels, which may lead to new risks or aggravate existing ones. Coordination between all is therefore very important, clearly defining the roles and duties of the different workers and identifying them all and their tasks.

6.1 Lifting out operations

When a vessel is entering or leaving a dock, only the persons required for the docking or undocking operation should be on board. During the docking or undocking operation, the workers should remain on the open deck. The only exceptions to this rule should be the persons required to operate the vessel.

During docking and undocking operations, the dock should be securely closed so that persons not engaged in the operation are not exposed to danger. Cranes in floating docks should always be secured against any inadvertent movement during docking or undocking operations.



Before docking and undocking of the ship, the stability of the operation should be checked by the dock manager in cooperation with the competent ship's officer

Before work begins on a vessel in dock it should be cleaned of silt, dirt or ice; the hull should be earthed; the propellers and the rudder should be blocked; and the fire-extinguishing system should be connected to the dock water mains.

Travel-lift is a specialised type of crane used for lifting boats out of the water and transporting them around shipyard. These cranes allow boats with masts or tall super structures to be transported around hard stands as the tall mast can pass into the centre of the crane. The travel lifts typically have two rectangular sides joined by a single spanning beam at the top of one end. The crane is mobile with four groups of steerable wheels, one on each corner. Boats are typically lifted using straps, slung between the two sides which can be passed under boats when either in the water or on the hard stand. Steel wires on pulleys are used to lift the boat. To remove a boat from the water, the boat is positioned in a narrow dock, or lifting well with two paths along each side, which are at the same level as the hard stand. The travel lift can then be driven onto the paths so that it is positioned over the boat. The boat can then be lifted above the level of the hard stand and driven around to the place where it is to be lowered. The ship is safely protected from damage by the surrounding steel girders. Incorrect positioning of the straps can cause damage. Paint damage in particular is often caused by dirty or scratchy belts. Due to the width of the lift, other ships or parts of buildings are at risk when manoeuvring. Travel-lift does not operate in high winds, icy or snowy conditions.



Image 10. Lifting out a boat with travel-lift - Source: CETEM



The main risks presented by the operation of lifting out the boat with travel-lift and their preventive measures would be the following:

- Running over other workers or being entrapped between objects and the travel-lift or even on the moving parts of the travel-lift. Person who are using travel-lift should have adequately and sufficiently train and being authorised to operate this vehicle. No other workers could be in the are of work of the travel-lift. The manoeuvre and the lifting out must be planned in advance until the boat is deposited in the corresponding place, so that no worker is in the itinerary, and it is free of obstacles.

- Falling or collapse of boats from the travel-lift. Due to an inadequate grip on the load or a breakage of cables, slings or other lifting accessories, due to overloading or lack of maintenance. It is compulsory that, at no time loads greater than the maximum load of the travel-lift recommended by the manufacturer be lifted.

In high wind conditions, no lifting operations shall be done. Carry out regular maintenance on the travel-lift and lifting gear, especially before use. Lift boats with the slings at the places provided by the manufacturer on the hull so that they are lifted in a balanced condition. If these locations are not provided on the hull of the boat, they should be determined prior to the lifting operation, using the boat's drawings if necessary.

Falling or collapse of vessels which are out of the sea. Once dry, boats, if they have not been correctly positioned with the appropriate fastenings, could lose their balance, causing the boat to collapse. To prevent that, it has to be placed the boats on a sufficient number of fastening elements, which shall be determined prior to the lifting out operation. These fastening elements shall be sufficiently strong to withstand the loads due to the weight of the vessel.

- Fall of persons remaining on the deck of the vessel to a different level during the lifting operation. This is a clear risk, for that, never operate the travel-lift if there are people on the boat. All crew members must leave the vessel as soon as possible and shall not re-enter the vessel until the travel-lift has lowered the vessel into the pit and the deck is at the height of the edge.

- Persons falling from the travel-lift to a different level during handling, as well as during raising and lowering operations of the boat. It is necessary to be careful and do all the activities really slow and working facing the travel-lift and using at least three points of support in the travel-lift



6.2 Launching and Sea Trials

Launching is a key event in the life of any ship. There are a number of different launching methods, including sideways launching, slipway launching, floating out from drydocks, and using travel-lifts. Each method has its own particular risks that must be adequately addressed by the yard's launching procedures.

For example, slipway launches use gravity to carry the ship into the water; but the vessel's must be checked and controlled and this method also requires a ship design that can withstand the stresses imposed by the transition from the slip to the water

In this case, risks and measures are similar to the ones of lifting out operations

Unit 7. Exposition to harmful or toxic substances

This is one of the most important risks that you could face when you are working with ships because it is necessary to manipulate and use substances that it could be harmful for the organism, for that it is compulsory to take all the necessary measures to avoid any possible risk. Also, it will be taken all the measures for eliminating or controlling exposure to hazardous substances (including dusts, fumes and gases) including:

- Handling, storage and transport of hazardous substances
- Disposal and treatment of hazardous chemicals and hazardous waste products

In fact, it is necessary to prepare an inventory of hazardous substances involved in shipbuilding or ship repair and in which tasks would be involved, also it will be written down the quantity of each one (it is recommended to store only the amount needed to perform the task, never more than enough). This list should highlight those substances which are mutagens, carcinogens and reproductive toxins.

Even, in the case of a ship repair, that list will include the inventory of hazardous substances on the ship done in advance because each ship shall have on board an Inventory of Hazardous Materials verified either by the Administration or by any authorized person taking into account guidelines, including any threshold values. Moreover, if it will be recycled the ship.

It will be monitored and recorded the exposure of any worker to the hazardous substances that are present in the workplace in order to be sure that it is not exceeded the exposure limits or other criteria. It could not be exceeded under no



circumstances. The record should be accessible to all workers who might be affected by the use of the chemicals, and to their representatives

It is recommended that all chemicals that it is using will be labelled or marked and give their relevant characteristics and instructions on their use, including the chemical safety data sheets. The mark chosen should be such as to enable users to distinguish between chemicals during receipt, handling and use. Marking may be by chemical identity, common name, trade name, code name or number or other name, so long as the identity so established is unique and, in the case of a hazardous chemical, is identical to that used on the label and the chemical safety data sheet. Inclusion of the name of the supplier on the shipped container or packaging is recommended. Hazardous chemicals should be labelled in accordance with national law and practice to give essential information (at least classification of the chemical, its hazards and precautions to be observed), as well as the identity of the chemicals, in a way that is easily understood by the workers who are to use them.

It should be taken appropriate measures to protect every person who are working in this field against the risks with hazardous substances identified by the assessment of risks. Where the risks cannot be eliminated or adequately controlled, it should be provided and maintained personal protective equipment, including clothing, and should implement measures to ensure its use. For that, first measure is to design work tasks with the suppression of use of hazardous substances or substitution for safer ones.

One of the main measures it is with the working area, it should be designed and prepared to avoid unnecessary exposure of workers to hazardous chemicals, this should include the provision of local exhaust ventilation, ensuring that cleaning can be kept to a minimum, and facilitating maintenance and cleaning procedures. The local exhaust ventilation should be so designed, constructed and installed as to ensure either the safe and effective removal of contaminated air from the workplace to a safe place, or the filtering or treatment of the contaminated air to avoid further hazard, taking into account exposure limits or other criteria for the control of the working environment established, approved or recognised by the competent authority. It should also be so designed as to prevent the spread of fire and explosion. Moreover, the exhaust ventilation should be located as close as possible to points of emission of hazardous chemicals

Adding to these, Work areas should be supplied with clean air to balance the volume of extracted air as it is exhausted through the various extraction systems. This ensures efficient extraction and helps to reduce concentrations of chemicals. The flow rates of general ventilation should be sufficient to change the air of the work area according to safety and health requirements



In some cases, when the risk is high, it is recommended a formal written procedure, where it is state exactly what work is to be done and when and which parts are safe, it will be revised by a responsible person and worker should understand the hazards and necessary precautions.

When those measures cannot ensure the full protection, it is compulsory to use personal protective equipment, that it could be included respiratory protective equipment, protective clothing and footwear, equipment to protect the face, eyes and hands, and equipment to prevent an accumulation of static electricity. It was mentioned in a previous unit, but it is necessary to remark that they should afford adequate protection against the risk from those hazardous chemicals to which the wearer is exposed, throughout the period during which such equipment is necessary, having regard to the type of work.

Workers should make proper use of all protective equipment throughout the time they are exposed to the risk provided for their protection or the protection of others, but previously they have to be fully instructed in its use. Moreover, they have to report any situation which they believe could present a risk, and which they cannot properly deal with the current measures.

Finally, it should be made adequate arrangements to deal with incidents and accidents involving chemicals, for example accidental exposure, inadvertent release, or fire or explosion. The arrangements should deal with the identified risks and include, where appropriate, the provision of fire-fighting equipment, fire alarms and release containment measures. Where the identified risk warrants it, the emergency arrangements should include evacuation of the workplace and the locality. Workers should be trained in the relevant procedures (including arrangements for raising the alarm, evacuation of working area or actions to minimise the incidents)

Adequate first-aid arrangements should be provided. These arrangements should take account of the hazardous chemicals used at work, ease of communications, and the emergency services and facilities available. They should be in accordance with any requirements laid down by the competent authority and available in every moment. These should be strategically placed to allow for their immediate use in the event of an emergency.

Also, as it was mentioned, suitable fire-fighting equipment should be provided for the quantity and characteristics of the chemicals used at work. Firefighting and fire-protection equipment should be maintained in full working order, which should be ensured by regular inspection. Workers should be instructed about appropriate

fires involving chemicals and appropriate precautions to be taken, and it should be clear that they do not have to put in risk unnecessarily

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