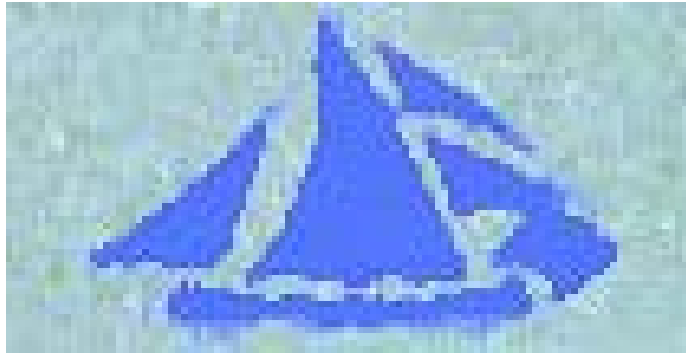




Occupational Safety & Health Administration

U.S. Department of Labor

SAFETY
and
HEALTH
INJURY
PREVENTION
SHEETS



Working with the Shipyard Industry

Process

SHIPFITTING



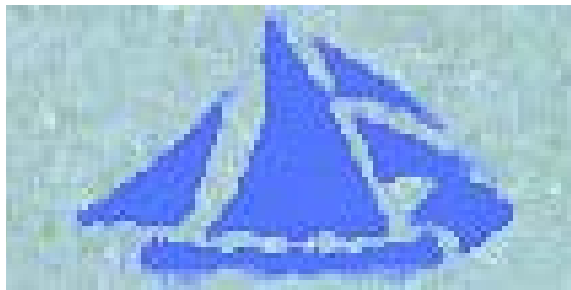
Falls

The shipyard is a very dynamic work environment. For the shipfitter, the vessel or vessel section is the workplace and it is in a constant state of change while under construction, being refitted, or repaired. Shipfitters' work can constantly take them from one area to another on the vessel and they may encounter many fall hazards on a daily basis. For example, access cuts in deckplates to install or remove vessel components can create a hazard for anyone moving through the area if proper guarding is not used. Likewise, coverings such as staging boards or gratings can be moved from one location to another so care must be taken to ensure that temporary coverings are used.

Shipfitters must make sure that if they create a potential fall hazard that appropriate measures are put into place to protect fellow employees. Good housekeeping practices also reduce the potential for slips, trips and falls.



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Falls

Problems



Service lines, hoses and leads on deck that cross over walkways present potential tripping hazards.

Missing plates or grating may cause injury to shipfitters, particularly if they are carrying equipment, tools, or other material that prevents them from seeing the hazard.

Solutions



Option 1

Neatly arranging the lines, hoses and leads, and using ramps as crossovers, will help eliminate tripping hazards and lessen the possibility of damage to service lines.

Option 2

Using brackets made of pipe, often referred to as "trees," is another method for keeping lines, hoses and leads off the deck. Below decks, hangers may be used to keep passageways free of trip and fall hazards.

Replacing grating when leaving the work area or covering deck openings with temporary covers (as shown here) are good methods for preventing injury.

Falls

Problems

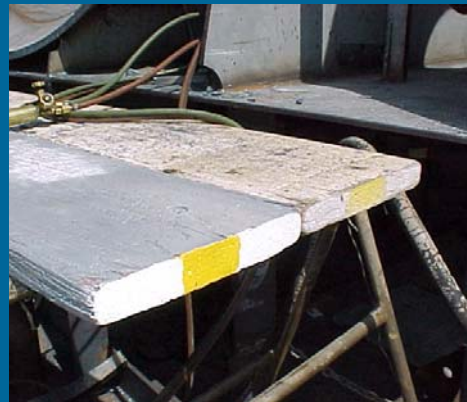


Deck openings or penetrations create fall hazards if not properly guarded.

Horse staging is frequently used to access areas where work is to be done. While fall protection such as back rails is not required unless the staging is above five feet, working from a single plank is not a safe or acceptable practice. A fall of just a few feet can result in serious injury.

During ship construction or refitting, trip hazards may be unavoidable and may pose the potential for impalement.

Solutions



Pipe guardrails can be quickly erected to provide adequate fall protection. Make sure that the materials to provide fall protection are readily available on hand prior to removing the cover or to making an access cut. This will eliminate the need for the shipfitter to leave the unguarded opening unattended while obtaining the necessary materials for fall protection.

Double planking with two 10-inch planks provides the extra width needed to ensure that a step backward will not end in the emergency room. Planks must extend at least six inches beyond the supports, but not more than twelve inches. When horse staging reaches five feet in height, fall protection (such as guardrails) must also be used and toeboards may be needed as well.

Studs and pipe caps (as seen here) can prevent trip or fall hazards from resulting in impalement.



Falls

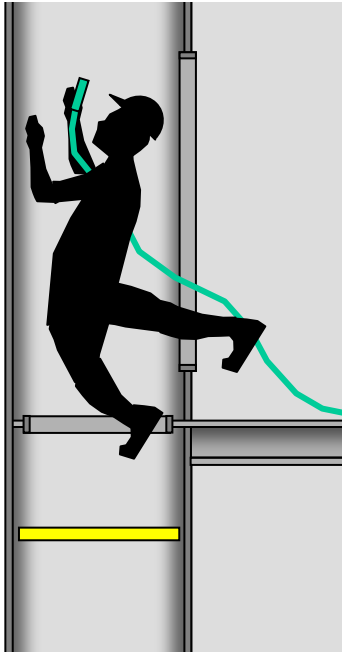
CASE HISTORY 1

A shipfitter was given the job of burning two T-bars inside a trunk.

The trunk was located off of a compartment and had only minimal lighting. The employee stepped inside the trunk thinking that there was a platform at the same height as the opening.

The platform actually was located more than two feet down and he fell. Fortunately, the platform kept him from falling down the entire trunk.

The shipfitter suffered bruises and a leg injury.



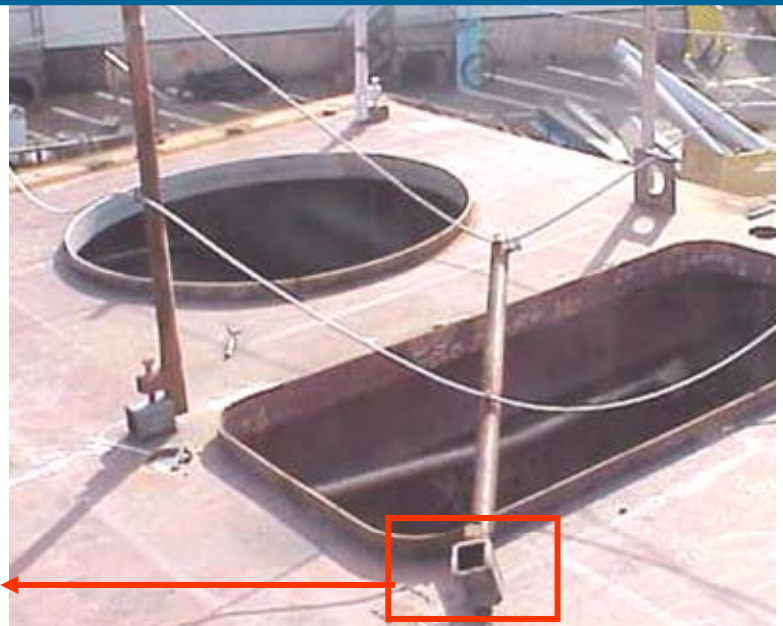
Analysis and Preventive Measures

Although inadequate lighting contributed to the accident, there are other contributing factors. There were no warning signs posted to inform employees entering the trunk of the risk or yellow and black caution tape. This accident could have also been prevented by training employees on safe workplace practices, and inspecting the work area.

CASE HISTORY 2

Two shipfitting employees were leaning on the same fall protection cable. A deck clip broke free and the employees fell toward a three-by six-foot deck opening.

Fortunately, the employees regained their balance and did not fall into the opening.



Analysis and Preventive Measures

The clip was discovered to have an inadequate weld, and the employees should not have been leaning on the cable.

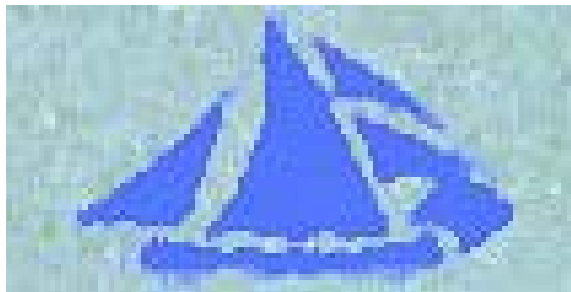
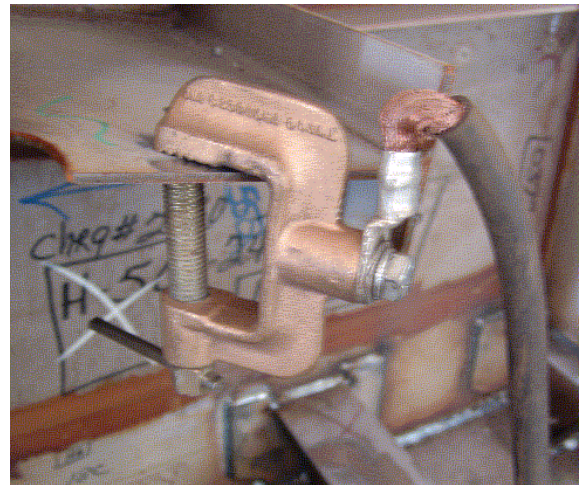
The critical nature of these welds warrant a clear inspection/sign-off process on fall protection measures.

Burns and Shocks

Shipfitters perform tasks that may expose them to burn and electrical shock hazards. For example, burning operations present a hazard from open flame and heated steel surfaces.

Working with electrical welding equipment on conductive surfaces that may be wet at times exposes the shipfitter to the potential of electrical shock.

(For more information see Hot Work SHIPS at http://www.osha.gov/dts/maritime/slrc/ships/ships_combined.pdf.)



Burns and Shocks

Problems



Paint build-up or corrosion can create a poor grounding condition when using welding equipment.

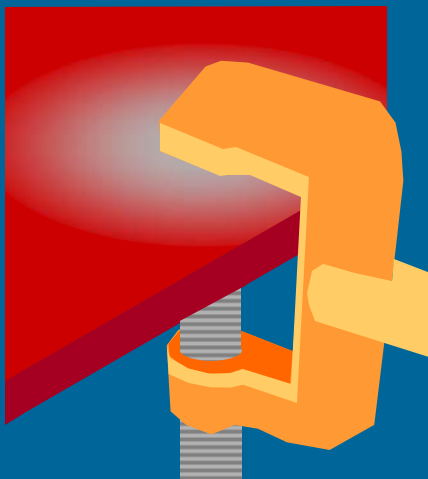


Shipfitters cutting steel usually remember to use hand protection. Unfortunately, workers assisting them may get burned if they don't wear gloves. The second-degree burns shown above resulted when a shipfitter accidentally passed the torch over the hand of a helper who was not using gloves.



Sharp edges in the shipbuilding and ship repair workplace can easily damage cable insulation. Cable exposed by the missing insulation can create a potential for injury.

Solutions



In welding operations, one of the cornerstones of shock prevention is creating a good electrical ground when using welding equipment. Removing paint build-up or corrosion from the contact area with wire brushing or a grinder will ensure successful grounding.



Everyone working or assisting in shipfitting activities involving hot work must wear gloves.



All welding cables must be completely insulated and capable of handling the maximum current requirements of the job. Before starting a welding job, a shipfitter needs to make a quick visual check of the entire cable to identify potential shock risks.

Burns and Shocks

CASE HISTORY 1

A shipfitter was setting up his welding equipment. As he installed the whip to the feeder, one hand came in contact with the metal end or nozzle of the whip (1) his other hand grasped the wire from the feeder (2). This completed the 80-volt electrical circuit which allowed the 80 volts of electricity to run across his chest.



The employee sustained burns to his hands and was transported to the hospital for treatment.

Analysis and Preventive Measures

• Never touch live electrical parts!

- Before setting up equipment be sure the power source is secured.
- Be sure switches are set to the proper position for the job you are going to do.



- Wear dry, leather insulating gloves in good condition to prevent “live” parts of welding equipment from touching bare skin or wet clothing.

Burns and Shocks

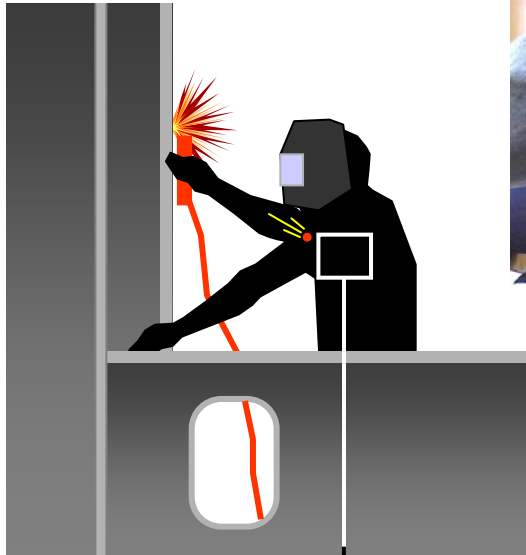
CASE HISTORY 2

While performing hot work, sparks from the job caught in the frayed edge of an opening in the shipfitter's coveralls.

The threads acted like a candle wick and pulled the fire deeper into the fabric.

The fire quickly spread to other clothing that was underneath the employee's coveralls including a t-shirt made of a synthetic material. When the fire reached the t-shirt, it burned even faster and began to melt onto the shipbuilder's skin.

Co-workers burned their hands while helping to put out the fire. The employee was hospitalized and underwent a painful recovery process.



Remains of the t-shirt



Analysis and Preventive Measures

- Protective clothing is only as good as its condition. Protective clothing must be intact and without frayed edges.
- Wear appropriate safety gear to protect yourself. Leather sleeves, for example, are fire retardant.
- Check your clothing to make sure it is in good condition prior to performing any hot work.
- Avoid synthetic clothing material due to the increased risk of rapid burning.

Burns and Shocks

CASE HISTORY 3

An employee came back out on the deck after a sudden rain storm. He was in a hurry to move the welding machine to complete a job before lunch.

The shipfitter knew not to stand in the water while working with electrical equipment, but he failed to notice that the thin plywood he stood on submerged the moment he stepped on it. His clothes and boots were already wet from the storm.

When he touched the equipment, the circuit was completed and current ran through his body.

The employee had to be taken to the hospital for treatment.



Analysis and Preventive Measures

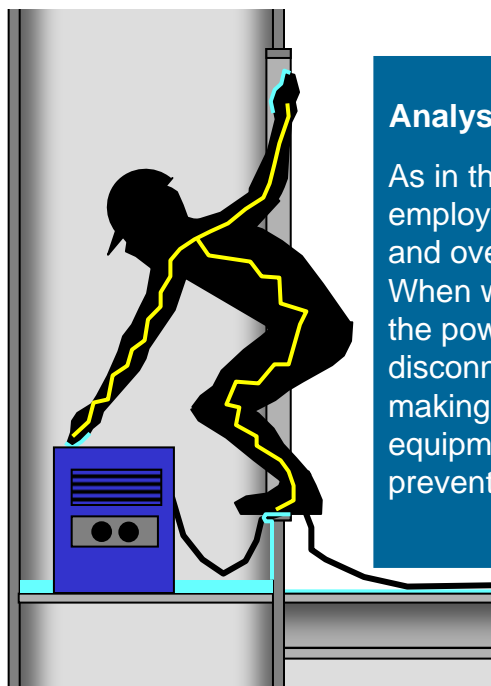
The shipfitter had underestimated the risk of shock and overestimated his margin of safety. His first step should have been to trace the power back to its source and disconnect the equipment before attempting to move any equipment. Training may help to prevent these types of injuries.

CASE HISTORY 4

When a shipfitter arrived onboard the ship at the start of a shift, he discovered water on the deck from an overnight rainstorm. He knew of the risk of shock, so he stood on the coaming around the door opening before reaching for the welding machine.

Unfortunately, both his boots and work gloves got soaked on his way to the job site.

When the employee touched the welding machine, he completed the circuit and current ran through him. He had to be taken to the hospital for treatment.



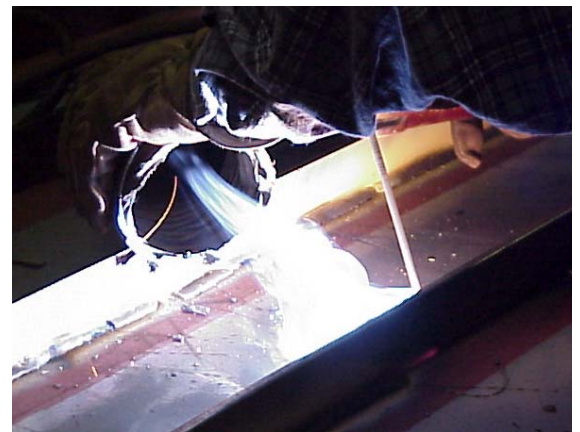
Analysis and Preventive Measures

As in the previous example, the employee had underestimated the risk and overestimated his margin of safety. When water is present, always trace the power back to its source and disconnect the equipment before making contact with any piece of equipment. Training may help to prevent these types of injuries.

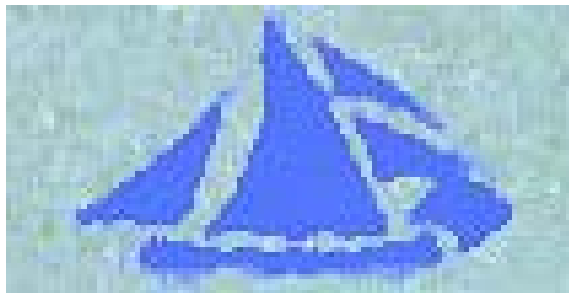
Overexposure (Welding Fume)

Like most shipyard employees, shipfitters may work with substances or processes that have the potential for creating overexposure to substances in the workplace. The risk of overexposure is particularly a concern when shipfitting operations are performed in enclosed and confined spaces.

The danger of overexposure, for example, may come from inhalation of welding fumes (see Hot Work SHIPS at www.osha.gov/dts/maritime/index.html) or working near potentially harmful substances or materials. In addition to controlling exposures through proper exhaust ventilation, respiratory protection also may be necessary. The risk of overexposure to harmful substances also can occur through dermal absorption. Where such risk exists, protective clothing is necessary to protect employees. Prevention of overexposure requires both recognition of the potential hazard and knowledge of the various prevention methods, including providing adequate washing facilities, and prohibitions against eating, drinking, and smoking in work areas to prevent recontamination and cross-contamination.



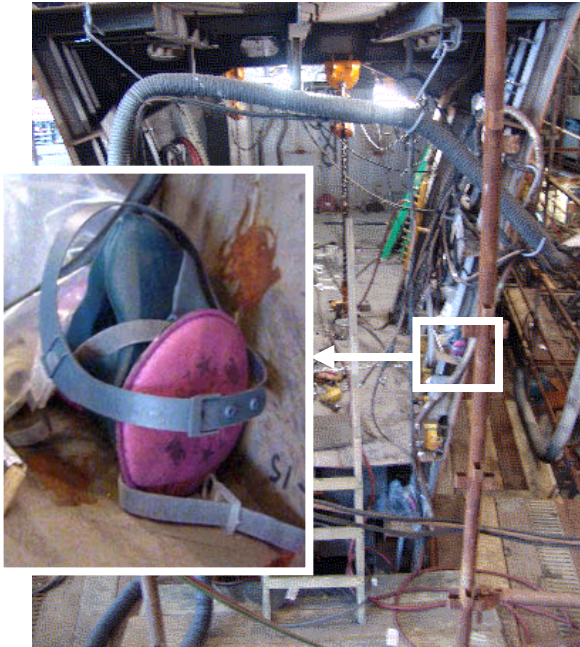
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Overexposure

Respirators must not be left exposed in the workplace when not in use. Grit and debris found throughout the shipfitting job site can diminish their effectiveness.

Problem



Respirators left out at worksites after the end of a shift.

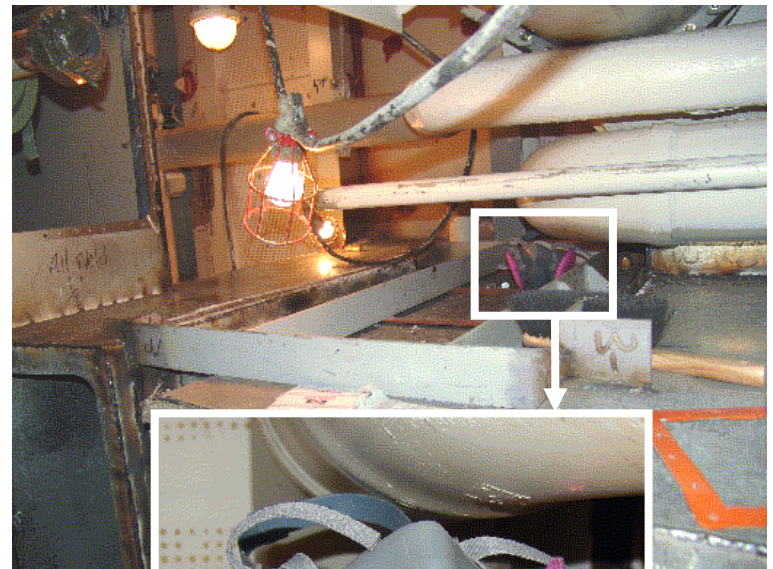


Solution

OSHA requires that respirators be stored after cleaning in a manner that protects them from damage or contamination. For example, a plastic bag with seals is an easy and inexpensive way to do this. Some shipyards make respirator filters and wipes available for cleaning at area tool cribs.

Therefore training should include the importance of using clean PPE.

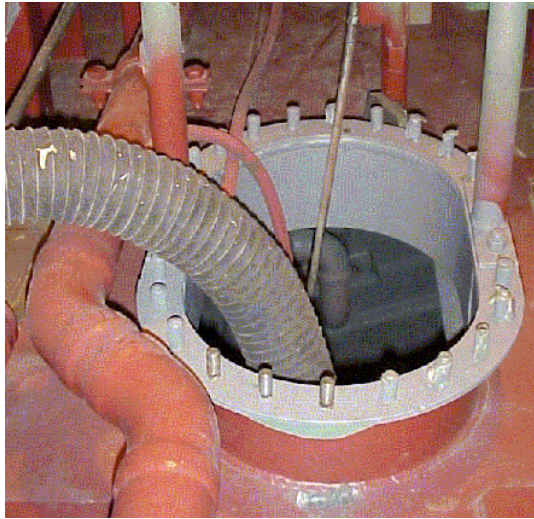
It is important to make the above resources available near all job sites and consistently follow up with employees to ensure compliance.



Overexposure (Welding Fume)

CASE HISTORY

While working in a confined space, a shipfitter began to cough and feel light-headed. He lifted his welding hood and noticed excessive fumes surrounding him. He was able to get out of the space and into a more open area where co-workers helped him get outdoors. Fortunately, the only immediate result of the overexposure was that he suffered a headache.



Analysis and Preventive Measures

Following the ventilation tube back through the ship, it was discovered that a splice in the vent tube had failed. As a result, there was not adequate ventilation in the confined space where the employee was working. The shipfitter should inspect the vent before and during work to ensure proper air flow.

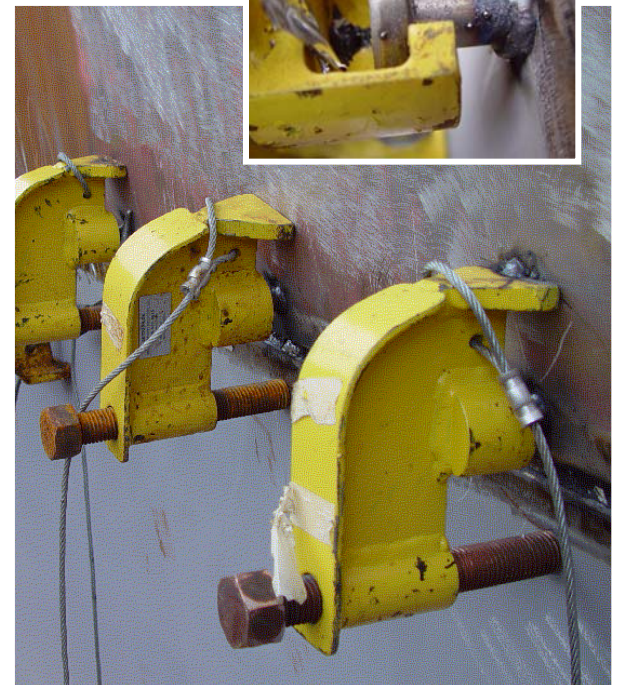
It is also important to regularly review correct splicing techniques with crews and to encourage periodic checks of vent line condition in order to help prevent this sort of incident.



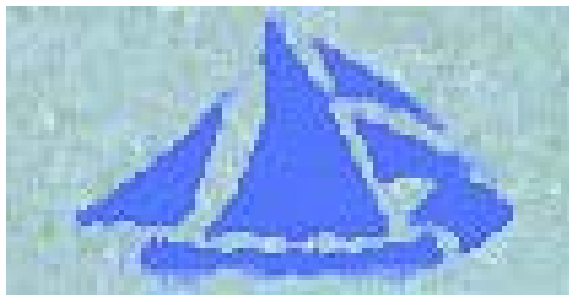
Ventilation needs to work properly to protect everybody in a space

Traumatic /Acute Injuries

Shipfitters are exposed to the risk of traumatic or acute injury from a variety of sources. They routinely work with tools and materials capable of producing lacerations, amputation and other injuries. A periodic inspection and maintenance program is important to ensure that tools and equipment are in proper working condition. Routine inspections can identify tools and equipment that are in need of servicing or repair and ensure that they are removed from service so employees are not exposed to a hazardous situation.



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Traumatic Injury/Acute

Unauthorized Tool Modification

Although it may seem that problems can be solved by modifying existing tools, doing so can create grave danger to both the user and those working near-by. Tools should only be used for the purpose for which they were designed. If the tool is modified, an engineering review is required prior to using the modified tool to ensure that it will safely perform under multiple load conditions.

The C-clamps shown at right were modified with good intentions, but actually created a hazard.



In the top photo, the clamp on the left failed under load, causing the metal being clamped to suddenly be released.



The clamp shown in the bottom photo was identified and removed from the worksite before it could be used. Later examination indicated that it would have failed under the intended load.

It is imperative to establish and reinforce a policy that strictly prohibits tool modification without proper authorization, and creates the opportunity for employees to develop tools, jigs, and fixtures that are correctly engineered.

Problems

Solutions

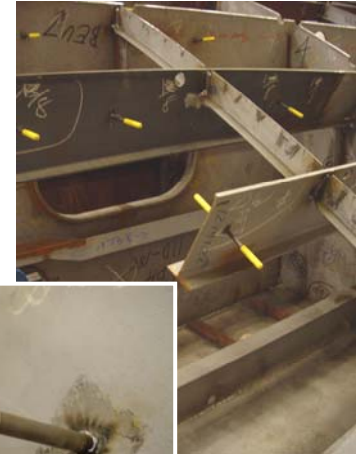
Problems

Exposed Insulation Pins



Shipfitters work in areas with exposed insulation pins that are capable of inflicting puncture wounds.

Depending on how quickly the insulation will be installed, either warning placards, plastic pin covers or bending the pins over may be used to reduce this danger.



Solutions

Traumatic Injury / Acute

CASE HISTORY 1



A shipfitter was fairing the deck with fishtails at the time of the accident. He was using an air ratchet to tighten the fourth fishtail when the stud holding the first fishtail broke free. The bolt from the fishtail struck him high on the left side of his forehead causing a serious head injury. At the time of the accident, the shipfitter was not wearing his hard hat.

The shipfitter did not expect the stud holding the fishtail to fail. Even though the first fishtail took a great deal of torque to fair the deck, he was still able to attach two additional fishtails without a problem. It was only when he was cinching down the fourth one that the first fishtail failed.



Analysis and Preventive Measures

In this situation, several things could have prevented this accident. Shooting another stud on a piece of steel scrap might have improved the application of the first stud. The shipfitter could have put equal torque on all the studs to spread the load more evenly. The shipfitter's injury also could have been prevented if he had been wearing his hard hat.

Maintaining employee awareness of workplace safety requirements, such as using PPE (hard hats and safety glasses) at all times, and the possible consequences of the sudden release of potential energy is very important in reducing the risk of injury. This can be accomplished through training, periodic safety talks and posters.

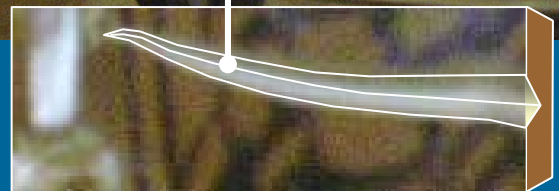
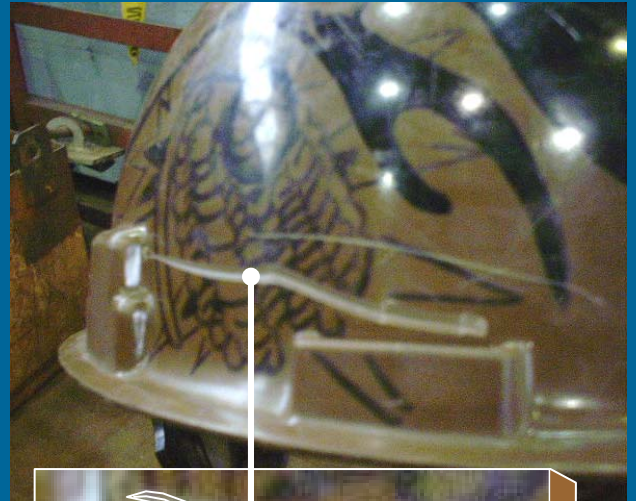
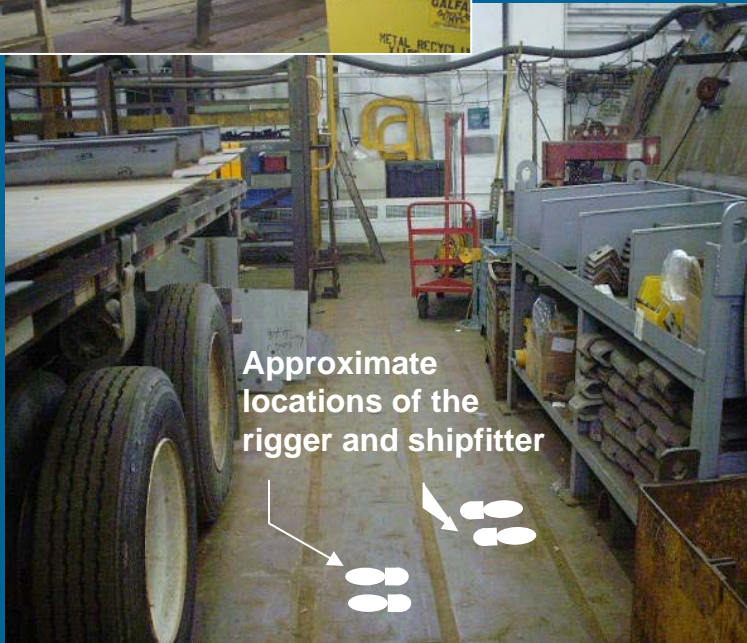


Traumatic / Acute Injury

CASE HISTORY 2

A shipfitter was getting material from an area adjacent to where a rigger was offloading bulkheads. The rigger watched the load as it was being unspooled to be placed in a storage rack. As the material (bulkhead) came up, it caught under another plate. When the rigger pushed on the bulkhead to break it free, the bulkhead shifted.

As the bulkhead pivoted on the trailer, it struck the shipfitter who was standing with his back to the load. The edge of the bulkhead struck the shipfitter on the right side of his hard hat, just above the rim. The force knocked the shipfitter down to the ground and onto a stock box beside the slump area.



The edge of the steel plate that swung out dug a furrow into the shipfitter's hard hat

Analysis and Preventive Measures

While his injuries were not life-threatening, if the shipfitter had been caught between the bulkhead and another object, this situation might have caused a severe injury or possibly death. Loads being picked up (or "lifted") have the potential to swing or move from side to side, and, in this case the shipfitter was not restricted from the dangerous area.

Following the incident, management established a practice that requires that the immediate area be secured from other personnel while offloading trailers.

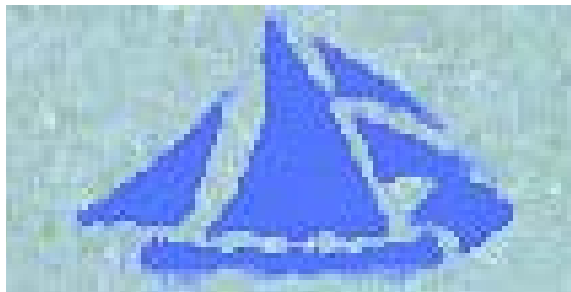
Eye Injuries

Eye injuries are one of the most prevalent hazards in all phases of shipbuilding and repairing. Shipfitters may be exposed to the ultraviolet and radiant energy involved in welding or cutting. Flying particulates, dust, and other debris are generated, not only by the work being done by the shipfitter, but also by other work taking place nearby.

Although most eye injuries do not result in permanent damage, they are almost always painful and there is always a potential for loss of sight in one or both eyes. Fortunately, with selection and use of proper personal protective equipment, most eye injuries can be prevented.

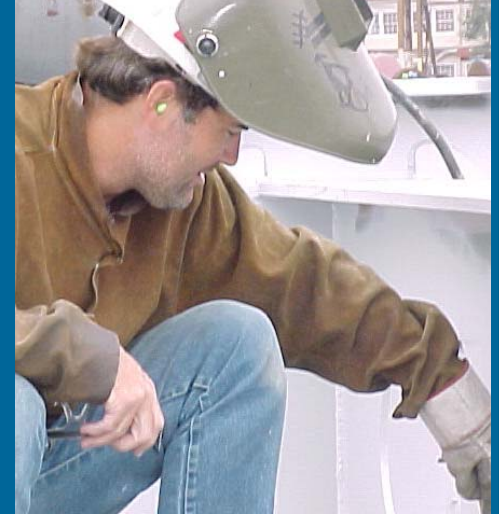


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Eye Injuries

Problems



Wearing standard safety eyewear, even if it has side shield protection, may not be enough to prevent foreign bodies from getting embedded in the eyes during operations such as grinding. High-speed grinding operations can produce fast-moving particles that can fly under or over the safety glass frames and get into employees' eyes.

This shipfitter appears to be ready to weld. So what's wrong with this picture?

Shipfitter is not wearing safety glasses.

Solutions



Option 1

Safety goggles with a seal can provide more complete protection against grinding dust getting into employees' eyes if safety glasses with side vents are not sufficient. Goggles have ventilation and/or special lenses to prevent fogging.

Option 2

Wearing a safety face shield that covers the entire face or wearing a face shield over safety glasses are options that may provide necessary additional protection from grinding dust, especially if the dust is dropping from above. If respiratory protection is required, a full-face respirator provides the needed level of protection against both grinding dust and respiratory hazards.

Safety glasses under the welding hood are necessary to provide protection from flying particles that may be generated by adjacent operations. This is a safety requirement in most shipyards.

Eye Injuries

CASE HISTORY

A shipfitter was grinding and wearing both safety glasses and a face shield as required by company rules. During a stretch break, he raised his face shield, causing metal particles generated by the grinding to fall onto his face behind his safety glasses and into his eyes. When his eyes became itchy and watery he reported the injury to his supervisor, who sent him to the medical department for treatment.



Analysis and Preventive Measures

The frequency and potential severity of this type of injury led the shipyard to seek a permanent solution. A major safety equipment manufacturer was contacted. With input from shipyard employees, the manufacturer developed a prototype bracket frame featuring a firm rubber seal designed to form a barrier that will prevent debris from falling onto the face and into the eyes. The prototype is now being evaluated by the shipyard.

In the meantime, employees have been made aware of this problem during safety talks and are being instructed on the proper way to prepare and remove their face shield. They have been told to apply duct tape over the seam between the brim of the hard hat and the face shield bracket to form a seal. In addition, they have been told to lean forward when removing the hard hat, keeping the face-shield and seal intact instead of flipping the shield. The shield can then be inspected for debris, cleaned, and used again. Another viable solution used by other shipyards is to attach magnetic tape to the hard hat brim to prevent steel particles from falling onto the face when the hard hat and shield are removed.



Duct tape seal



Prototype manufactured face-shield bracket with barrier