

STANDARD SAFETY

SETTING THE STANDARD FOR SERVICE AND SECURITY

May 2011

PORTABLE LADDERS SPECIAL EDITION



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INTRODUCTION

This edition of Standard Safety concentrates on the subject of portable ladders and their use on ships. Judging by the results of the 360-plus surveys that the club carries out each year, and reviews of members' safety management systems, reference to the portable ladder is rarely included in companies' planned maintenance systems or in companies' training programmes. Yet this simple tool, that probably every seafarer has at home, is used very often in an unregulated and unsafe manner onboard ship. Ladders are frequently:

- used without supervision
- used when not rigged correctly
- used in dangerous situations, in an effort to get the job done quickly
- used when damaged and not fit for purpose
- not stored in a safe place

Even though portable ladders are familiar to all of us, they are rarely included in a planned maintenance system and rarely inspected formally. How often, for example, is there a ladder procedure in the safety management system to inspect or safely store or discard damaged ladders?

Since 2000, club records indicate that claims attributable to defective ladders or their inappropriate use have cost in excess of \$2.1m. Far more importantly, the incidents have resulted in serious injuries and even fatalities to seafarers. Failure to use ladders correctly costs lives.

Although this Standard Safety concentrates on the handling of portable ladders, the subject should be considered in context with other precautions for working aloft. This includes continuous risk assessments, permits to work and wearing of personal protective equipment including fall preventers.



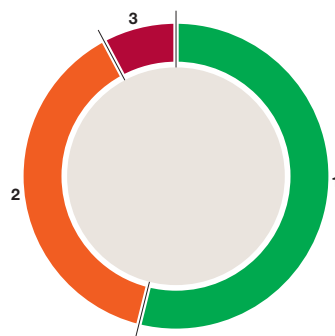
^ Portable ladders should not be used as a stage or a suspended platform to work from

CAUSES OF PORTABLE LADDER P&I CLAIMS 2000 TO 2010

Ships' crew frequently sustain injuries when using portable ladders. Such accidents are often attributed to poor maintenance, inadequate risk assessments and a lack of a safety culture. Portable ladders are part of everyday working life on ships and are commonly overlooked in planned maintenance systems. Safety harnesses and other essential safety equipment used in combination with portable ladders are frequently neglected when it comes to maintenance, repair and training procedures.

CAUSES OF PORTABLE LADDER P&I CLAIMS 2000 TO 2010

1	Accidents caused by lack of safety equipment	54%
2	Accidents caused by inadequate portable ladder training	38%
3	Accidents caused by poor planned maintenance	8%



COMMON HAZARDS ASSOCIATED WITH PORTABLE LADDERS AT SEA

- falls resulting from ladder failure (poorly-maintained or damaged ladders)
- falls from ladders placed at incorrect angles
- falls from ladders placed on or against unstable surfaces or platforms
- falls resulting from ladders slipping outwards at the bottom and sideways at the upper resting point
- injuries resulting from handling of ladders
- falls from ladders caused by electric shock
- falls from ladders in adverse weather conditions
- falls when working alone

CASE STUDY A

In a recent incident, an experienced engineering officer fell 20 ft from a straight aluminium ladder (without ladder extensions) onto the tank top of a cargo hold. The engineer was found unconscious, wearing a safety harness with a fall arrestor by his side that was clearly not attached. He had planned to connect the arrestor to a pad-eye above the area where the work was intended. The ladder was not tied down, and movement of the ship made the ladder fall from beneath him. The ladder was not secured at the base and no other crew members were present. The worker suffered a fracture of the skull, two broken ribs, and permanent damage to his sensory functions.

The incident was caused by the unsafe angle of the ladder and the fact that the rubber surface on one of the ladder's two feet was missing, therefore offering little grip. Crew members from the ship later testified that portable ladders were rarely inspected or maintained and were primarily used above deck to plug in refrigerated containers.

LESSONS LEARNT

Always conduct a full risk assessment for the work activity. Make sure the equipment, area where work is taking place, personnel and weather conditions have been factored into the assessment.

Never allow any ladder to be used if it is not in good condition, of suitable height and construction, and properly maintained.



^ Portable ladder badly stowed, and is blocking safety equipment



^ A severely damaged portable ladder beyond repair. This ladder should not be used

CASE STUDY B

An experienced seafarer was rigging a chain block to an outboard crane davit close to the ship side. He was working alone and not wearing any personal protective equipment (PPE) nor a life vest, and no risk assessment or permit to work had been issued. He had taken a portable ladder (without proper rubber pads on its feet) from the deck store room. While the ladder was resting on the davit arm, it slipped on the deck. The seafarer fell overboard and his body was never recovered. The ladder was found resting horizontally on the deck.

LESSONS LEARNT

Always:

- use a ladder that is in good condition
- secure the ladder
- work in teams of at least two crew members
- conduct a risk assessment and obtain a permit to work
- wear PPE, including a life vest, if necessary

CASE STUDY C

A subcontracted electrician was carrying out electrical installations 6 m above a working deck while the ship was alongside in port. The subcontractor, who was wearing full PPE with a safety harness that was not secured to a strong point, fell to the deck. Because he was working alone, the incident was not witnessed. He later died from his injuries.

LESSONS LEARNT

Always:

- monitor the work of subcontractors
- conduct a risk assessment and obtain a permit to work
- ensure subcontractors work in pairs or that crew members are designated to assist individual contractors
- secure the ladder



^ Poorly maintained and damaged portable ladder. This ladder should be removed from use and disposed of



^ A portable ladder with visible signs of damage. This ladder should not be used

CASE STUDY D

Two seafarers were cleaning and scraping rust scale from the hopper side of a bulk carrier hold. The ladder was laid on top of the hopper side. One crew member was at the top of the ladder scraping rust scale and the other was holding the bottom of the ladder. Sea conditions were good and the ship was rolling easily.

The crew member carrying out de-scaling asked his colleague to fetch a long-handled scraper so he could reach higher up. The seafarer holding the bottom of the ladder left to fetch the tool from the forecastle store while the other man remained at the top of the ladder.

When he returned to the hold 10 minutes later, he found the seafarer who had been on the ladder lying on the tank top with severe back and head injuries. The injured party was evacuated from the ship soon afterwards.

LESSONS LEARNT

Always:

- work in pairs – never allow any crew members to work on a ladder alone
- secure the ladder
- inspect the ladder before use
- use only ladders in good condition



^ Poor stowage of portable ladder on deck



^ Portable stepladder kept in the engine room showing signs of rusting, not stowed on a rack or kept away from heat sources

PLANNED MAINTENANCE OF PORTABLE LADDERS

Ladders should be included in the company's planned maintenance system.

It is essential that portable ladders are inspected periodically to ensure their integrity is maintained and they are safe for use.

The inspection process should be conducted by experienced and trained crew members, with detailed records retained onboard. Records of inspections are a useful reference and help to contribute to providing a pro-active attitude towards safety culture.

Any deficiencies should be reported to the safety officer, and a defective ladder should be removed from use. If the ladder is beyond repair, as per manufacturer's instructions, it should be destroyed. Rarely can a damaged ladder be effectively and safely repaired. Colour coding or tagging ladders may prove a useful way of keeping track of ladders and their appropriate use onboard ship.

CASE STUDY E

An able seafarer was standing on a portable ladder while de-greasing the port lifeboat davit arm. Although the working height was above 2 m, no risk assessment had been made nor had a permit to work been issued. The seafarer was not wearing a safety harness nor any type of fall prevention device.

It was claimed by the crew member that the right leg of the ladder collapsed which made him fall and injure himself. Initially he was treated onboard for relatively minor injuries to his arm, but one month later he made a further complaint to the medical officer about his back and hip pain. He was sent ashore to seek medical attention and a doctor found him unfit for duty.

The lack of maintenance and regular inspections of the portable ladder was the primary factor in this incident. If a risk assessment had been conducted, it would probably have identified that the ladder was poorly maintained and defective, and an accident might well have been avoided.

LESSONS LEARNT

Always ensure that portable ladders and associated safety equipment are included in the planned maintenance system. Always conduct an inspection before use.

Club rule 15.1 (5) states that a member must comply with the International Safety Management Code (ISM). Under Regulation 10 of ISM 'Maintenance of the ship and equipment' the company is required to ensure the ship is maintained properly and regular inspections take place. This should be in the form of a planned maintenance system under which all kinds of equipment onboard should be included e.g. portable ladders.

PORTABLE LADDER CHECKLIST

SAFETY/INSPECTION/STORAGE

Safety	Yes	No	N/A	If no, suggested action
Are portable ladders included in the planned maintenance system?				Include all portable ladders onboard in the planned maintenance system
Are portable ladders included in working aloft risk assessments?				Include portable ladders in risk assessments
Do portable ladders meet approved manufacturer standards? (This can be shown on the ladder certificate and in the form of a seal or stamp on the ladder, stating month and year of construction, and maximum rated load)				If there is no manufacturer certificate, stamp or seal of approval on the ladder, remove ladder from use. Check with company procedures and ship's responsible officer if it is safe to use
Have crew members had practical training with portable ladders?				Include portable ladder training in onboard training
General ladder inspection – applies to all ladders	Yes	No	N/A	If no, suggested action
Is the ladder free from bends, cracks or breaks?				Remove ladder and destroy
Is the ladder fully intact?				
Are the ladder's rungs and treads in good condition?				
Are the bolts and rivets (if fitted) in place and secure?				
Are the ladder's feet in good condition?				
Is the ladder free from rust and corrosion?				
Are locking mechanisms intact and working?				Use a light machine oil to lubricate pivoting/moving surfaces
Are all pivoting or rotating surfaces of the ladder lubricated?				
Wooden ladders	Yes	No	N/A	If no, suggested action
Is the ladder free from signs of rotting, heat damage, vermin attack, or wood worm and general wear and tear?				Remove ladder and destroy
Is the ladder protected with a clear protective coating?				Use appropriate wood preservative
Is the ladder free from paint hiding defects and cracks?				If cracks or defects are found, remove ladder and destroy
Is the ladder free from signs of warping?				Remove ladder and destroy
Are the rungs and treads free from decay or damage?				Remove ladder and destroy
Aluminium ladders	Yes	No	N/A	If no, suggested action
Is the ladder free from distortion along the stiles?				Remove ladder and destroy
Are the rungs tight and secure?				Remove ladder and destroy
Are all rivets and fastenings in good condition?				Remove ladder and destroy
Is the ladder clearly marked: 'NOT TO BE USED NEAR ELECTRICAL EQUIPMENT OR SUPPLY'?				Mark ladder with the appropriate sign
Stepladders	Yes	No	N/A	If no, suggested action
Are the hinges fully working?				Tighten hinges if loose
Are the brackets, spreaders and platforms in good condition and not loose or bent?				Remove ladder and destroy
Is the stop on the hinge bracket or spreaders fully working?				Remove ladder and destroy
Storage	Yes	No	N/A	If no, suggested action
Is the ladder stowed safely in a dry, ventilated space away from any heat source, leaking chemicals or damp?				Store ladder in a clean and dry atmosphere, remove any residues
Is the ladder stored in or on a rack when not in use?				Store ladder on a suitable rack
Does the ladder storage rack have sufficient points of support to prevent sagging?				Store ladder on a suitable rack
Is the ladder free from any material placed in or on it while stored?				Remove material stored in or on ladder

PORTABLE LADDER STANDARDS AND CLASSES

Portable ladders should be stowed horizontally on racks with suitable number of support points



^ Portable ladders stowed incorrectly in a forecabin store



^ Not to be used on ships Class 3 domestic ladder – manufacturer sticker (image courtesy of McGinness Industries)



^ Don't let this happen to you. Always use a safety harness and fall prevention device when working aloft

There are no rules or standards that dictate the quality or supply of portable ladders onboard ship. However, good practice in relation to maintenance and supply should prevail.

All ladders supplied to ships should adhere to nationally accepted standards from the manufacturing country of origin. In the UK and the European Union for example, there are three main classifications of ladders which specify minimum requirements for portable ladders regardless of use or type including stepladders, platform steps and extension ladders. Fixed ladders, for example access ladders in cargo holds, must conform to separate standards and are not intended for classification under these standards.



Class I ladders are the highest rated portable ladders in terms of strength and quality. These ladders are strongly recommended for use onboard ships as they are suitable for heavy duty industrial applications and environments.



Class EN131 (European standard) is a Europe-wide classification. Ladders of this classification are more suitable for light work than Class 1 ladders.



Class III ladders are only suitable for domestic use and should never be used onboard ships as they are not designed for heavy duty industrial purposes.

It is important to recognise and understand the safe working loads for different portable ladders when carrying out maintenance work onboard ships. The safe working load strives to cover the average weight of a single person and their equipment and is commonly referred to as the 'maximum static vertical load'. This load, however, does not take into account any dynamic of the asymmetric forces and it is the duty rating which should be used.

The maximum static vertical load of each class of portable ladder is as follows:

- CLASS I = 130 kg
- CLASS II or EN131 or equivalent = 110 kg
- CLASS III = 95 kg

Company procurement departments should stipulate that portable ladders supplied to the ship conform to an appropriate standard. Companies can dictate to suppliers that goods supplied should conform to a relevant standard. This standard should ideally conform to those listed above or equivalent. If such supply is not possible, the ladder must be thoroughly checked by a responsible officer.

When receiving new portable ladders onboard, the responsible officer should ensure the ladder conforms to manufacturing standards by checking the certificate issued with the ladder and the certification plate on the side of the ladder. The certification plate should state as a minimum the ladder classification and safe working load or maximum static vertical load. The portable ladder certificate and manual should be consulted to check the recommended maintenance procedure and inspection frequency. This should be incorporated into the planned maintenance system.

WORKING ALOFT

Portable ladders are given little attention within the shipping industry, even though seafarers are continuing to sustain injuries when using them.

Accidents resulting in claims have occurred because of poor ladder maintenance, lack of safety equipment and poor ladder training. Investigators have been told by crew members involved in accidents when working aloft that they had not received practical training with portable ladders, and that portable ladders were not checked as part of their planned maintenance system. This presents a serious oversight in safety measures, as portable ladders are a critical piece of equipment when working aloft.

The Code of Safe Working Practice (COSWP) issued by the UK Maritime and Coastguard Agency (MCA) provides guidance on the safe use of portable ladders (Section 3 Chapter 15 'Safe Systems of Work'). UK Marine Guidance Notice (MGN) 410 (M+F) 'The Merchant Shipping and Fishing Vessels (Health and Safety at Work) (Work at Height) Regulations 2010' has published further information on the subject, including rigging and positioning of ladders and their safe use. Other jurisdictions may have issued similar advice.

Despite this, there is at present very little information within the maritime industry and available to shipowners on portable ladder maintenance, quality standards and related crew training. It has been common practice in the industry to describe 'working aloft' as working at a height of 2 m or more. The advice contained in MGN 410 is that any work at height should be considered potentially dangerous and be subject to the same safety precautions for 'working aloft' as for a height of 2 m or more:

'The provisions of the Work at Height Regulations 2010 apply to all work carried out "at height" where a person could fall a distance liable to result in an injury to them. For this reason the "2 metres rule", previously utilised for land based works, and informally applied to maritime workers, no longer applies. These Regulations apply irrespective of whether work is being carried out at 2 metres or above or below 2 metres.' 1.1.4 MGN 410 (M+F)

The relevant flag state regulations should be first consulted as these may vary from the advice given above.

Falls from heights of 2 m and below can cause serious injuries and this possibility has been commonly overlooked in risk assessments and permits to work. Risk assessments for 'working aloft' should be adapted to include any work activities carried out 'at height' and should include the use of portable ladders.

It is recommended that any work carried out 'at height' should be considered as 'working aloft' and that a full risk assessment/permit to work be carried out.



^ A severely damaged portable ladder beyond repair. This ladder should not be used

CHOOSING THE RIGHT PORTABLE LADDER

HEIGHT

When conducting a risk assessment for work requiring a portable ladder, the height needed to reach the working area should be determined to select the correct length of ladder.

When using a portable straight ladder to reach an upper platform, ensure the ladder extends at least 1 m (or top four rungs) above the stepping off point. Additional length of ladder may be needed to compensate for the reduction in height caused by setting the ladder at the correct angle against the resting point.

Recommended ladder heights for pitch angle of 70°

Height of work	Recommended ladder height
3.0 m	4.2 m
4.0 m	5.2 m
5.0 m	6.3 m
6.0 m	7.4 m
7.0 m	8.4 m

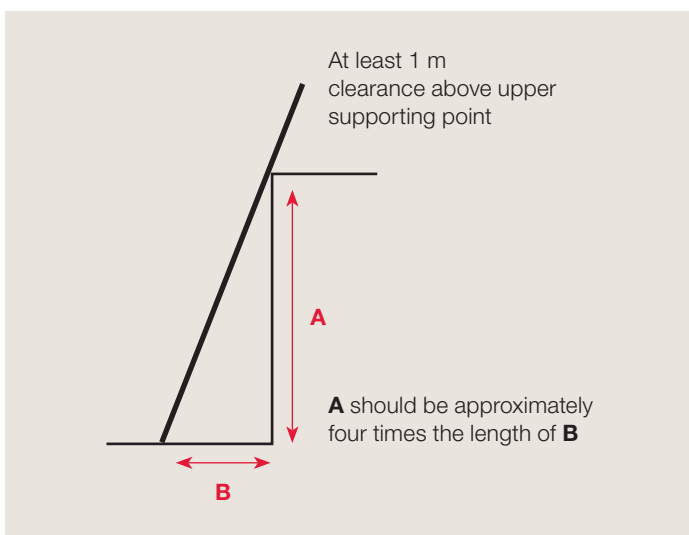
CONSTRUCTION AND MATERIAL OF LADDERS



^ Portable ladders must be placed at the correct pitch angle

HORIZONTAL DISTANCE

The horizontal distance between the foot of the ladder and the support against which the ladder rests (B) should be approximately a quarter of the height of the ladder at the top of the upper supporting point.



^ Straight ladders with extensions are often used to reach greater heights

When selecting a portable ladder for a work activity, the material used in the construction of the ladder should be taken into account. Hazards include:

- electric shock from ladder conductivity (aluminium ladders)
- putting excessive weight on non-malleable ladders, causing them to snap and fail (fibreglass ladders)

WOODEN LADDERS

Advantages

- do not conduct electricity when dry
- best insulator against heat, among all materials used for ladders
- hardwood ladders such as hickory or oak provide great natural strength

Disadvantages

- prone to drying and splitting through wear and tear
- need constant upkeep with suitable clear protective coating to preserve and protect ladder
- easily damaged
- shorter working life span than aluminium or fibreglass ladders
- usually heavier than aluminium ladders

FIBREGLASS LADDERS

Advantages

- do not dry out or split when exposed to sunlight or stored near a heat source
- slower to conduct heat than metal ladders
- can withstand high temperatures for short periods without permanently damaging their structure
- if the fibreglass used in construction contains self-extinguishing resin, it will only burn as long as a direct flame is applied to it
- most fibreglass ladders do not require additional protective coating to maintain them

Disadvantages

- heavier than most wood or aluminium ladders
- fibreglass chips or cracks when dropped
- not a 'malleable' material like metal, meaning they will not bend when overloaded but will crack and fail

ALUMINIUM LADDERS

Advantages

- more resilient to tough working conditions
- made of high tensile metal
- do not chip or crack when dropped
- do not need any protective finishes
- will not dry out or weather with age or exposure to sunlight
- strong construction, durable and light

Disadvantages

- conduct electricity
- conduct heat very rapidly
- once exposed to extreme heat, may become annealed and reduce load capacity even if there are no visible signs of damage

PORTABLE LADDER RIGGING

Portable ladders should only be used when there are no safer means of access.

Before rigging a portable ladder:

- conduct a risk assessment
- obtain permit to work when carrying out work at height
- consult onboard safety management system for guidance
- conduct tool box talk with all crew members involved
- ensure crew members have training for portable ladders, and know safety procedures
- check ladder is clean and in good condition
- check maximum stated load of ladder (safe working load and maximum static vertical load)
- check the location of work is safe and check potential rigging positions of ladder
- consider the movement of the ship and effects of weather when planning the rigging position

When rigging a portable ladder always ensure:

- the working height does not exceed 9 m
- the ladder is pitched between 60° and 75° from the horizontal
- the ladder is placed so as to give a clearance of at least 150 mm behind the rungs
- the ladder extends at least 1 m above any upper landing area unless there are other suitable handhold arrangements
- the ladder is properly secured against slipping or moving sideways at the base and the top by using a rope lashing
- the deck area is dry, free from clutter including any residues that may cause slipping or shifting of the ladder
- the deck where the portable ladder is to be positioned is on firm and stable, level 'ground'
- a safety harness and fall FPD are utilised when working at height (FPD may be in the form of an inertia reel or fall arrestor block)
- the safety harness and FPD are connected to a strong point on the ships structure and checked before the person ascends the ladder
- FPD is of correct length to be effective
- both hands are free for safely ascending and descending a ladder; no tools or equipment to be carried
- the seafarer faces the ladder while ascending and descending
- three points of contact (hands and feet) are established at the working position on the ladder
- there is sufficient overlap between extensions on ladders that extend
- there is a competent person at the base of the ladder to oversee the operation
- if a portable ladder is resting against a bulwark or rails, that there are suitable points of safe access to the deck
- there is sufficient lighting available to illuminate the ladder and work space
- wooden or fibreglass ladders must be used when electrical hazards are present

Never allow:

- crew members to use portable ladders without a risk assessment having been completed
- any work to take place on a portable ladder without consulting the onboard permit to work system and working aloft procedures
- portable ladders to be used in bad weather or where the movement of the ship could cause injury
- portable ladders to be used without a safety harness when carrying out work 'at height'
- portable ladders to be used without being properly secured
- portable ladders to be placed and secured on top of boxes, barrels or other unstable bases or platforms
- crew members to use portable ladders alone
- poorly maintained or broken ladders to be used
- crew members to be on a portable ladder for more than 30 minutes
- standing on the top three rungs of the ladder
- crew members to overload the ladder – weight of person and anything being taken up should never exceed the maximum load stated for the ladder
- the portable ladder to be rigged in a position where the crew member must overreach to work
- portable ladders to be used as an access over the ship's side, nor hanging from the accommodation nor over the hatch coaming
- portable ladders to be used as a horizontal walkway or walkway platform
- portable ladders to be placed in front of doors that open toward the ladder unless the door is locked or guarded
- two portable ladders to provide support for a stage or working platform

CASE STUDY F

An experienced able seafarer was using a portable ladder on the deck of a container ship to check the lashings. For the past three months, he had used the ladder for the same job, without wearing a safety harness or FPD.

After placing the ladder on an unstable platform near a walkway and without using a safety harness, the seafarer climbed the ladder. The uneven distribution of weight on the ladder resulting from its bad positioning caused him to fall 3 m onto the deck. He suffered extensive spinal injuries which effectively ended his seagoing career.

LESSONS LEARNT

Always make sure a thorough risk assessment has been carried out and that all safety procedures have been followed. Always use a safety harness connected to a strong point on the ship structure even if the height is considered small. Tasks involving the use of ladders when checking the lashings on container ships should be included in a 'generic' risk assessment and routinely reviewed.

A lack of safety culture causes accidents and costs lives. Make sure all crew members are fully aware of the dangers associated with portable ladders and working aloft.

SAFETY PRECAUTIONS

An analysis of claims involving ladders reveals that those who fall and are injured often say in their defence that they had not been provided with adequate training in the use of ladders and safety harnesses. The analysis suggests most people who fell were not wearing any type of safety harness or FPD even though such equipment was available on the ship. This implies a lack of training and safety culture, involving a common practice of taking unacceptable risks with no thought of the consequences. A large number of accidents occur when a seafarer is working alone.

When working aloft with a portable ladder:

- wear an approved safety harness
- use a FPD connected to a strong point on the ship's structure: this may include a fall arrestor block or inertia reel which stops a person falling because their own weight activates the restraining device
- wear appropriate PPE: hard hat, gloves, boiler suit, safety shoes



^ A safety harness must be worn when working at height

TRAINING

It is recommended that all new crew members undergo familiarisation training in the use of portable ladders and safety harnesses as part of routine onboard training. Time should be taken to emphasise the hazards and risks associated with working aloft, and the need to use safety equipment correctly. Crew members should always be aware of the onboard risk assessment protocols and the permit to work system.

Crew should be trained in:

- the requirements of a risk assessment and permits to work
- using ladders only in good condition
- always working in pairs
- always securing the ladder
- always wearing PPE and FPD
- the need to stop anyone using a ladder in an unsafe manner

Only continuous and focused training will help develop a safety culture and reduce the number of accidents.



^ Dangerous act of working aloft. No safety harness or portable ladder present. This is not a safe practice

HUMAN ELEMENT IN PORTABLE LADDER SAFETY

A small amount of portable ladder injury claims have been blamed on the physical state of the seafarer concerned. Seafarers under the influence of alcohol or drugs create dangerous situations when involved with equipment of any kind, especially portable ladders. More than this, however, an aspect which continues to play a significant role in causing accidents is fatigue. Weakness, lack of energy, being constantly tired or exhausted, and lack of concentration all fall into this category and may contribute to an injury during work with portable ladders.

Seafarers should be well rested and not under the influence of alcohol when using portable ladders onboard ships.



^ Example of poor safety when using a portable ladder

KEY POINTS

- train your crew
- inspect ladders before use
- any risk assessments should include portable ladders
- portable ladder care should be included in planned maintenance systems
- work carried out using a ladder should be considered as working aloft
- develop a safety culture

The managers would like to acknowledge with thanks the assistance of Don Aers, Technical Manager, the Ladder Association in the preparations of this issue of Standard Safety.



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STANDARD SAFETY/ STANDARD CARGO PUBLICATIONS



Standard Safety: The Maritime Labour Convention 2006 March 2011

- Convention requirements
- Compliance planning
- Ship design
- Club cover
- Checklists



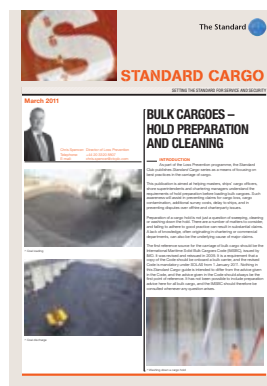
Standard Safety: Piracy December 2010

- UKMTO voluntary reporting requirements
- Piracy areas
- Industry consultation
- ISM Code and risk analysis



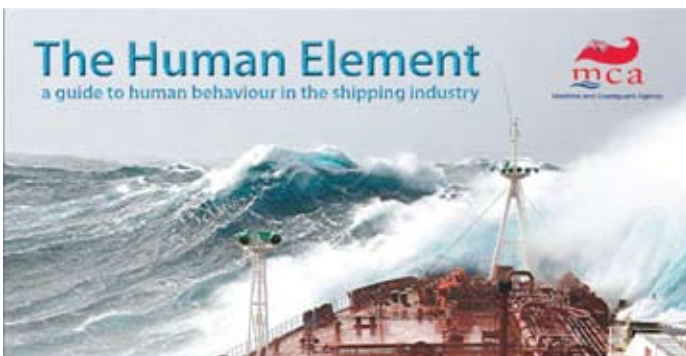
Standard Cargo: bulk cargo liquefaction (iron ore fines and nickel ore) February 2011

- Shipper's responsibilities
- Appointment of an independent surveyor
- Transportable moisture limit and flow moisture point
- Flow table and the can test
- Trimming
- Case studies
- Responsibilities



Standard Cargo: bulk cargoes – hold preparation and cleaning March 2011

- SMS
- Maintenance
- Hold cleaning, washing down and drying equipment
- Requirements for cargoes
- Case studies



The Human Element:

A guide to human behaviour that makes it clear that the human element is neither peripheral nor optional in the pursuit of a profitable and safe shipping industry. On the contrary, the capabilities and vulnerabilities of human beings are – and always will be – at the centre of the enterprise.

Standard Safety is published by the managers' London agents:

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