BEST PRACTICE GUIDELINES FOR STOWAGE AND SECURING OF STEEL CARGOES

INTRODUCTION AND STANDARDS

PENANGPORT

NORTHPORT

WESTPORTS MALAYSIA

JohorPort

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H160604

REGULATORY BACKGROUND & INDUSTRY STANDARDS

The safe stowage and securing of cargo is a mandatory requirement of the SOLAS[1] Convention. Chapter VI '*Carriage of cargo and oil fuels*', Regulation 5 '*Stowage and securing*' requires that:

"*Cargo, cargo units and cargo transport units carried on or under deck shall be so loaded, stowed and secured as to prevent as far as is practicable, throughout the voyage, damage or hazard to the ship and the persons on board, and loss of cargo overboard*" and

"*All cargoes, other than solid and liquid bulk cargoes, cargo units and cargo transport units, shall be loaded, stowed and secured throughout the voyage in accordance with the Cargo Securing Manual approved by the Administration*".

The IMO has published guidelines on the proper stowage and securing of cargo in the CSS Code. This code aims to:
"*…provide an international standard to promote the safe stowage and securing of cargoes…*"

The general principles of the CSS Code require that:

"*All cargoes should be stowed and secured in such a way that the ship and persons on board are not put at risk.*

The safe stowage and securing of cargoes depend on proper planning, execution and supervision.

In all cases, improper stowage and securing of cargo will be potentially hazardous to the securing of other cargoes and to the ship itself."

In addition, the CSS Code, when considering the '*Principles of safe stowage and securing of cargoes*', states in Chapter 2 that:

"*2.2.1 It is of utmost importance that the master takes great care in planning and supervising the stowage and securing of cargoes in order to prevent cargo sliding, tipping, racking, collapsing etc.*" and

"*2.6.1 The principle means of preventing the improper stowage and securing of cargoes is through proper supervision of the loading operation and inspection of the stow.*"

[1] '*IMO – International Convention for the Safety of Life at Sea, 1974 (SOLAS)*', as amended.

FOREWORD

Jurong Port, Johor Port, Northport, Westport and Penang Port (thereafter known as The Ports) have come together to develop these guidelines after collectively realizing that concerted effort was required to address this existing safety gap in the steel cargo segment.

"*The proper stowage and securing of cargoes is of the utmost importance for the safety of life at sea. Improper stowage and securing of cargoes has resulted in numerous serious ship casualties and caused injury and loss of life, not only at sea but also during loading and discharge.*"[2]

After an extensive and comprehensive review of the issues faced by stevedores during the off-loading of various steel cargoes, The Ports are now issuing the attached Guidelines, to be known as the *"Best Practise Guidelines for Stowage and Securing of Steel Cargoes"*.

The Ports have developed these Guidelines in close collaboration with Brookes Bell to assist vessel Masters' and ships' officers, port captains, load port agents and stevedores, charterers and shippers, when planning to load steel cargoes bound for Malaysia and Singapore. These guidelines are to be read in conjunction with the respective ports Stowage Policy which will provide timelines for enforcement including incentives and penalties.

The primary objective of these Guidelines is to ensure:

- The safety of all personnel engaged in cargo operations at The Ports.
- Expeditious discharge, resulting in efficient productivity and turn-round in the cargo handling operation at the disport.
- Avoidance of damage to the cargo during the cargo handling operation.

These *'Best Practice Guidelines for Stowage and Securing of Steel Cargoes*' have been written in keeping with recognised international industry standards and guidelines for the safe handling and stowage of steel cargoes by sea.

The Ports Best Practice Guidelines for respective steel products are attached as individual appendices.

[2] '*IMO – Code of Safe Practice for Cargo Stowage and Securing (IMO – CSS Code), 2011*', as amended.

COMMITMENT TO SAFETY

The Ports are unequivocal in their endorsement of the Guidelines and are fully committed to ensure enforcement of compliance.

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BEST PRACTISE GUIDELINES – OVERVIEW

These guidelines have been prepared to address the various operational and safety challenges as experienced by The Ports (TP) in particular, poor and unsafe stowage but cognizant of the lifting gears used for cargo handling in most neighbouring ports.

These guidelines include, but are not limited to, the following:

- Specify the methodology of bundling or packaging each cargo lot and minimum securing arrangements.
- Provide detailed dunnage type, quality, dimensions and spacing for different steel products.
- Provide detailed description on what constitutes good stowage taking into consideration cargo care throughout the shipment while contributing to safe and efficient discharging operations at Jurong Port.
- Take into consideration the cargo handling methods and equipment, with understanding of the same at most other load and discharge ports.

The types of steel cargo addressed in these guidelines are:

- Rebars
- Wire rod in coils
- Steel plates
- Steel pipes
- Steel coils
- Structural steel
- Ingots, Billets, Blooms and Slabs
- Combined stows

We have approached each guideline in a structured and sequential manner, providing a general overview for respective steel product and then, in respective sub-headings, bundling, dunnage, lashing, stowage, including under-coaming stowage and with schematics where considered appropriate, are addressed. Thereafter, the various stages of the preparation, loading, stowage, securing and lashing at the load port are illustrated, including arrival at discharge ports and the subsequent off-loading sequence and procedures.

These guidelines aim to present a storyline, in pictures where possible, which showcases the good, the bad and the ugly, with respect to the various cargo stows.

BUNDLING

Bundling has a key role in the cargo handling operations in ports, particularly for cargoes such as rebars, wire rod coils, small-diameter pipes, cold rolled steel plates, steel coils, and some structural steel units (H-beams, I-beams). Steel cargo in bundles allows for faster handling in ports, although not necessarily safer.

Generally, for bundling of steel cargo units, wires with bulldog grips, bundling wires and flexible metal bands (straps) are normally used. The use of bundling wires requires proper twisting of the ends – at least four turns. Depending on the way the bundling wires are twisted, attention should be paid to a risk of injury. They must always be sufficiently tightened to provide a compact and tight cargo unit.

Bundles shall not be slack, as this creates the risk of cargo slipping from the bundle during handling. Improper bundling may cause the unit to slacken during transits, which in turn, can develop into an unstable stow, prone to shifting.

When high-tensile flexible metal bands (straps) are used, these should ideally be secured and tightened using pneumatic tools, such as tensioners and sealers. The bands shall not be tightened by hand. The straps' ends should be pneumatically sealed by compressive metal joints. The metal bands may have different width and thickness. These details should be known to calculate the breaking strength of each steel band. In view of this fact, heavy steel coils, for example, of more than 15 tonnes, may require the straps to be increased in number by up to five and more in transverse orientation. The circumferential straps are usually 2 to 3 in number. Metal straps used for bundling of steel coils can be easily broken and, therefore, coils with insufficient and broken bundles should not be accepted for loading.

High-strength polyester straps may also be used for the bundling of ingots and billets because of their higher elongation properties, compared with the steel bands. The breaking strength of the polyester straps shall always be similar to that of metal straps – approximately 2.5 kg/cm^2. Whether using steel or polyester strapping, it is important that they are always within their working range, when applied.

When bundling is used for high-quality steel products, such as cold rolled steel coils and cold rolled steel plates, care should be taken that all edges of the cargo are properly protected to avoid mechanical damage.

Another purpose of bundling is to assist in the use of tipping hooks during the off-loading operation thus allowing the passing of lifting slings underneath the cargo units. In this scenario, a minimum of 2 double bundling wires with at least 4 twists should be provided one at each end and another in the middle to facilitate tip lifting process. The bundling wires, unless specifically certified for this, should never be used for overhead handling and off-loading.

The number of bundling wires shall be sufficient to provide a compact and tight single cargo unit, which subsequently will be secured in a single cargo block stow. Attention should be paid to the bundles of the rebars, as this cargo is flexible and easily bent.

Wire rods in coils (WRICs), when unprotected, will be formed into bundles and usually secured with four steel wires or, occasionally, strapping bands. Finished, protected, WRICs will usually be secured into bundles by strapping bands. These bundling wires or strapping bands are not designed for lifting and should not be used for this purpose.

It is a requirement of The Ports in the region that each WRIC is bundled by five equally spread, double bundling wires and not less. The bundling wires should be secured by at least four twists. The use of five bundling wires will prevent the lower tiers of WRICs from crushing under and will keep the stow tighter without a risk of collapsing. If straps are used, then five bundles should be made as well.

Small and medium-diameter pipes may be bundled together with dunnage to form a single cargo unit easy for stowage and handling. More details and schematics are provided in the individual steel cargo guidelines.

The bundling of small diameter pipes is usually made with steel strapping. The strapping should be tightly applied to avoid loose bundles and failed hexagonal shapes. The bundling may also take a square shape, where dunnage is then used between the tiers of the stow.

LASHING

Lashing of cargo is required to be completed prior to the vessel leaving the load port. The purpose of the lashing is to prevent the cargo from shifting, thus endangering the voyage. Steel cargoes, properly stowed, shall be secured in a single unified block and, where possible, to the vessel's hull or securing points.

Bulk carriers do not normally have securing points in their cargo holds and the lashing of steel cargoes, on bulk carriers, requires additional care and scrutiny.

Lashing has commonality across all types of steel products as there are several industry-accepted guiding principles. These principles are commonly used and practiced globally.

All lashings shall conform to the requirements of the vessel's Cargo Securing Manual and the CSS Code. A lashing and securing plan should be prepared prior to the loading of the steel cargo and, where required, accompanied by relevant calculations showing the maximum expected forces during the voyage.

The American Club, in their publication "*Transport Guidance for Steel Cargoes*", considers that, for ease of use, 16mm (6x12) wires with bulldog clips, turnbuckles and shackles would normally be used to lash steel cargoes.

For wires of up to 19mm diameter, when forming an eye with or without a thimble, a minimum of 3 bulldog grips should be used at a spacing of approximately 6 times the diameter of the wire. An allowance of approximately 5 times the diameter of the wire should be made between the last bulldog grip and loose end of the wire. The saddle of the bulldog grips should be on the live (load bearing) wire. The wires should be tightened by rigging screws (UK P&I Club "*Best Practise: The Application of Bulldog Grips*").

Right way of applying bulldog grips

Wrong way of applying bulldog grips

Diameter of wire ropes (mm)	**Bulldog grips** (Number)
Up to and including 19	3
Over 19: up to and including 32	4
Over 32: up to and including 38	5
Over 38: up to and including 44	6
Over 44: up to and including 56	7

The 7th edition of the Thomas Stowage guidelines suggests that the minimum number of bulldog grips is as follows:

- For wires between 12mm and 17mm – a minimum of 4 grips
- For wires between 19mm and 24mm – a minimum of 5 grips
- For wires of 25mm and more – a minimum of 6 grips

The lashing of certain cargoes, such as steel coils, may require special attention. Others, such as wire rod in coils, may not require firm-lashing, as the stow tends to settle during the voyage. However, lashing to a bulkhead is required for wire rods in coils partly loaded in cargo holds. Steel slabs, when properly dunnaged and stowed, may not require lashing; however, consideration should always be given to the use of chains for the lashing of this cargo.

The lashing of slabs, billets and blooms, tends to slacken-off because its weight tends to compress the dunnage used. Consideration shall be given to the monitoring of lashings, and tightening if required, during the voyage.

With respect to the lashing of steel cargoes, it is strongly recommended that a lashing and securing plan is drafted and discussed with all parties involved prior to the commencement of the loading operation. The master and all crew directly involved in the cargo loading operation should be familiar with the provisions of the lashing and securing plan pertinent to their vessel. The plan, and subsequently the lashing of the cargo, is to be done to the satisfaction of the master.

All relevant documentation and certification, for the lashing equipment used, shall be provided to the vessel's master, prior to, and on completion, of the lashing activity.

DUNNAGE

Dunnage also plays an integral role during the loading, transportation and off-loading of steel cargoes. Dunnage is required for, but not limited to, the following reasons:

- Increases the friction between cargoes and prevents shifting.
- Distributes the weight of cargo on the tank-top.
- Secures the cargo into one block.
- Protects and secures cargo units.
- Prevents deformation of long cargo units.
- Protects ship's plating, structures and frames.
- Levels the cargo on the tank-top and subsequent tiers.
- Segregates cargo units.
- Assists ventilation throughout the cargo hold.
- Assists in the slinging of the cargo for off-loading.
- Allows access for the tangs of forklift trucks without causing damage.

To achieve the above expectations and in accordance with industry good practice[3], the dunnage wood must be bark, oil and moisture-free, equally shaped and formed, ideally fumigated and free of insects, not mixed between hard and soft wood, and, last but not least, properly certified in accordance with the ISPM 15 "Regulations of wood packaging material in international trade". Hardwood dunnage should be used at the tank-top and throughout the first 6 tiers of rebars, primarily to withstand the cumulative weights of all tiers above.

Different cargo types require specific dunnaging by size, shape and structure, and this is addressed in the respective sections for each type of steel cargo.

Steel cargoes tend to shift if not correctly dunnaged, as there is very little friction between steel products laid directly atop each other. This can result in steel cargoes shifting at very small angles of roll. The use of dunnage increases the amount of friction between the two surfaces and therefore reduces the tendency of the cargo to shift during the sea voyage.

Timber dunnage must be laid athwartships or in the fore-and-aft direction, but always perpendicular to the direction of the cargo units. Prior to the loading of cargo, dunnage should be laid on the tank-top in sufficient numbers so that its use is effective in both supporting the weight of the cargo and evenly distributing that weight. Dunnage should be spaced at intervals, depending on the type of steel cargo loaded. The size of the dunnage boards used is also dependent on the steel cargo being loaded.

Dunnage shall be always used on the sloped areas of hopper tanks and on the bulkheads of the cargo compartments.

[3] Lloyd's Practical Shipping Guides – Steel: Carriage By Sea, 5th Edition 2009 (A. Sparks & F. Coppers).

Certain steel cargoes, such as steel coils, large-diameter pipes and structural steel, may require additional dunnage constructions to be built for preventing the cargo units from shifting during heavy rolling periods. These constructions are known as shoring and require planning and schematics, so that they are properly fabricated.

Dunnage is normally arranged and delivered at the loading port by the shippers and/or stevedores. It is not unusual if the size and type of the dunnage are not in accordance with these guidelines. If this is experienced, more dunnage may be required to achieve the desired result for a good block of cargo stow.

Certain cargo, such as wire rod in coils, ingots in bundles and T-ingots, are better stowed using plywood boards. The respective guidelines provide further information in this respect.

If the dunnage is not dry, this may produce moisture in the cargo compartment. Dunnage with moisture content more than 14% should not be used. When loading heavy cargo units, the dunnage may become crushed and the cargo may shift or be damaged. At the discharge port, crushed dunnage pieces present a safety hazard for the stevedores, as well as making it difficult for the stevedores to handle the cargo during the off-loading.

In the guidelines, reference is made to softwood and hardwood dunnage. The species of woods used as dunnage are numerous. A basic rule of thumb is that the hardwood type of dunnage should not crush under the weight of the cargo units. The dunnage must be fit for purpose.

The differentiation between soft and hard wood for the purpose of being used as dunnage material will depend on the geographical origin of the wood and its density. As an example, the National Wooden Pallet and Container Association has issued Uniform Standards for Wood Pallets describes five different types of wood with respect to their hardness for North America and Europe. For the Asian region, the wood used as dunnage shall be also certified as soft/hard wood or with high, medium or low density.

STOWAGE

All cargo shall be stowed in accordance with the IMO Code of Safe Practise for Cargo Stowage and Securing (CSS Code). The stowage is usually started with planning and cargo distribution.

Although the use of lashing and dunnage is important, it is primarily the correct stowage of the cargo, which can ensure the effectiveness and efficiency of the lashing and dunnaging.

During the loading operation, the stowage goes in hands with the dunnaging, whilst the lashing operation is a separate activity, which is often carried out by different people. Good stowage will aim at ensuring the following:

- Proper cargo distribution with respect to geographical rotation and sequence of loading and off-loading,
- Correct load distribution with respect to the whole vessel,
- Correct load distribution within each individual cargo compartment,
- To prevent damage or deformation to the cargo,
- To prevent damage to the vessel's cargo compartments,
- Good segregation of various parcels,
- Correct ventilation of the cargo on board,
- Efficient loading operation,
- Stability of the stow at sea during various weather conditions,
- Efficient off-loading operation,
- Safe cargo handling operation at both, the loading and off-loading ports,
- To allow the cargo to be delivered to the receivers in the same apparent good order and condition as it was when loaded on board.

Most of steel cargoes are shipped by bulk carriers and general cargo vessels. Bigger parcels of between 30,000 to 50,000 tonnes may require bulk carriers to be utilized rather than general cargo vessels. The two types of vessels have different construction of the cargo compartments.

General cargo vessels are characterized by having tween decks and lower holds. They usually have box-shaped cargo compartments, which facilitate stowage and cargo handling. Additionally, there are designated securing points, which are not common on bulk carriers.

The bulk carriers, on the other hand, have hopper-type, double-bottom water ballast tanks, resulting into a sloped shape of the cargo holds on the port and starboard sides. Stool spaces between the cargo holds may also have the same sloped form. These areas may be characterized with different strength than the tank-top and this fact should be well known by the vessel's crew, particularly when heavy steel cargoes (such as steel plates, slabs and steel coils) are loaded over the side hopper tanks.

Steel is a heavy cargo, and the cargo hold tank-top loading limits must be considered and observed during loading. The maximum height of the stow will depend on the allowable load limit determined by the shipyard and confirmed by the Classification Society when the vessel was built, and on the stowage factor of the cargo.

It should be remembered that this limit was calculated when the vessel was new; for older ships, with normal wear and tear on the tank-top plating and associated under-deck stiffening, it is prudent to allow a safety margin.

Some of the modern general-purpose bulk carriers are constructed with double-bottom and double-side water ballast tanks (or with double hulls). This construction results in box-shaped cargo compartments, without hopper areas. This type of construction significantly facilitates the handling of steel cargoes. With regards to the homogeneous stowage of steel cargoes in one cargo compartment, the cargo should be evenly distributed throughout the whole width of the compartment.

During the loading operation, the tiers and the stows should be properly levelled with correct application of dunnage. The final stow should be properly lashed into a unified block, as well as to the vessel's hull structure if possible. The vessel should never proceed to sea with unfinished last tier of cargo, particularly where the cargo units are heavy. Lashing, dunnaging, chocking and securing of an unfinished last tier is challenging and may not provide the necessary stability and guarantee from shifting in adverse weather conditions.

For combined stows of different steel cargoes, the most important approach would be to stow and segregate the parcels horizontally apart from one another, complying with the maximum strength limits of the cargo compartments. Where this may not be practical, because for example of the size and weight of different cargo units, the heavier units should be stowed under the lighter ones, i.e. the cargo with higher density should always be stowed first.

Given the different finishing and purpose of the steel cargoes, semi-finished cargo units, which are normally unwrapped and kept in the open, may very often be loaded wet. These should not be loaded and stowed together with finished and properly packaged products, such as cold rolled steel coils and pipes for example. The moisture given off the wet semi-finished products may affect the condition of the finished products.

Sometimes, such segregation is difficult to be achieved, however, depending on the apparent condition of the semi-finished goods, the master and the crew should aim at addressing this with the shippers during the planning stage and prior to the loading operation.

Where there is more than one parcel for various consignees and multiple off-loading ports, proper cargo segregation is required. This will allow for the remaining cargo to be levelled and to be properly lashed and secured prior to the vessel's departure from the first off-loading port.

The IMO "Code of Safe Practise for Cargo Stowage and Securing" and the MSC Circular 1353 "Revised Guidelines for the Preparation of Cargo Securing Manual" have provisions with respect to Cargo Safe Access Plan for vessels carrying containers on deck. Means for safe passage of crew on board ships are also introduced by regulation 25-1 of the International Convention on Load Lines 1966, as modified by the 1988 Protocol.

Each vessel should ensure the safe access of personnel to the relevant stows of cargo in the vessel's cargo compartments at any time when the vessel is at sea and in port for safety reasons. A ship's specific plan should be prepared based on the cargo parcels to be loaded, and the access points should be presented and discussed prior to the commencement of the cargo off-loading operation by the vessel and shore personnel.

UNDER-COAMING STOWAGE

All cargoes are off-loaded at The Ports by vertical lift only. If vertical lift is not or cannot be implemented, depending on the depth of the under-coaming area, the lifting wires of cranes and derricks can be easily damaged because of the contact with the coamings and their edges. Additionally, this may cause the cargo to swing, once lifted, causing damage to the cargo, the ship's structure, or personal injury to stevedores.

The Ports use fork lift trucks to move cargo from the under-coaming areas into the hatch square, where plumb-lifting by crane or derrick can be done in a controlled and safe manner. This requires that cargo units and bundles, stowed in under-coaming areas, are stable and well dunnaged between each tier. Depending on the type of steel cargo, the cargo units may need to be pre-slung.

Different stowage orientation may also assist in providing direct access to the cargo in these areas. Each individual cargo-type guideline aims to address this issue and guarantee a safe and efficient cargo discharge operation.

REFERENCES

IMO – Safety of Life at Sea Convention (SOLAS), 1974 as amended.
IMO – Code of Safe Practise for Cargo Stowage and Securing (CSS Code), 2011 as amended.
ILO – Code of Practise – Safety and Health in Ports, 2005.
ILO – Register of Lifting Appliances, 1985.
UK MCA – Code of Safe Working Practices for Merchant Seafarers, 2016.
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GUIDELINES

01. REBARS
02. WRIC
03. STEEL PLATES
04. PIPES
05. STRUCTURAL STEEL
06. COILS
07. INGOTS, BILLETS, BLOOMS, SLABS
08. COMBINED STEEL PRODUCTS

REBAR

GENERAL

Rebar, or deformed high-tensile steel bar, is hot rolled and is typically stored in the open. It is shipped in unprotected bundles secured by lengths of steel bundling wire bands wrapped around the bundles at intervals, with the ends twisted together. These bundling wires hold no strength and shall not be used for overhead lifting. However, this bundling arrangement can be used for tipping of the bundles with tipping hooks. The number of bars per bundle will vary with the diameter of the bars within the bundle. Bundles are typically 6, 9 or 12 meters in length. For example, the 12 meter bundle is the most commonly imported length at Jurong Port and weighs approximately 2 tonnes.

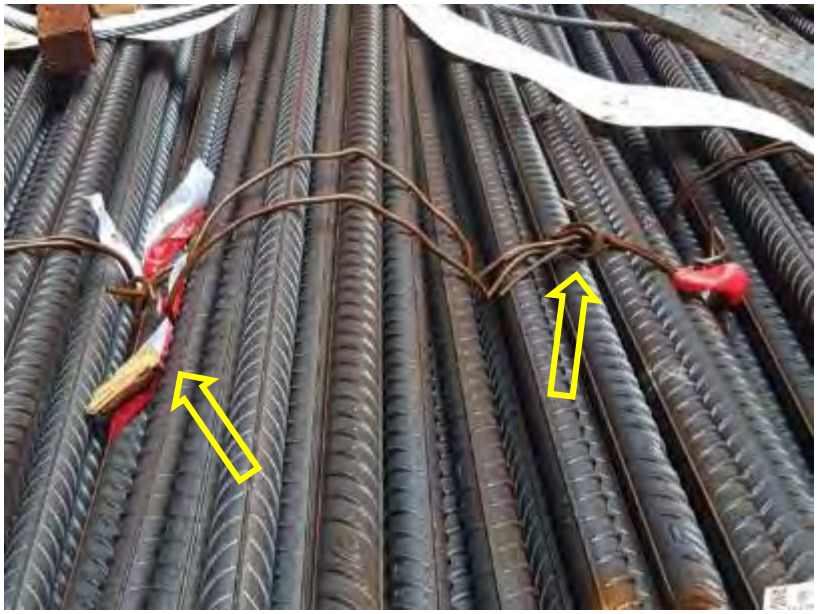
Rebar in open storage prior to shipment showing signs of corrosion.

Bundling wires along the length of the bundles are not designed for lifting but can be used for tipping.

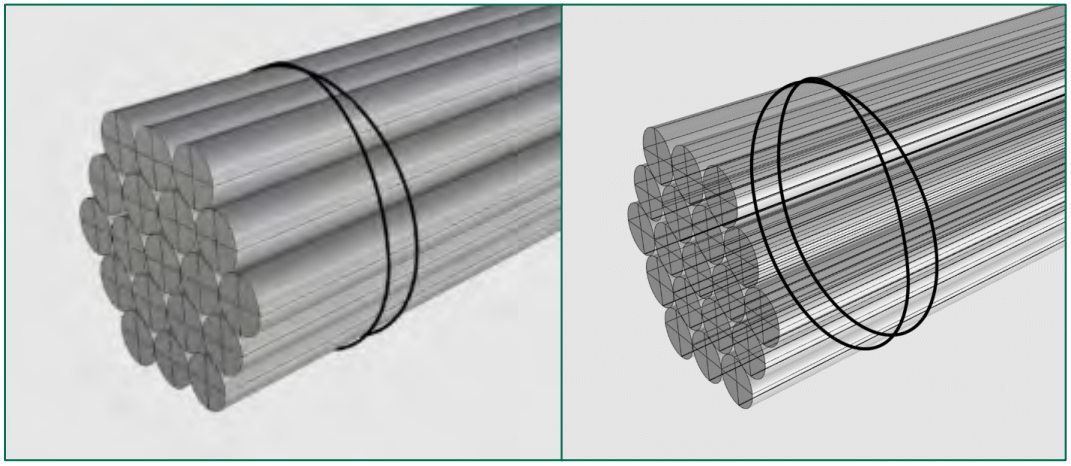
REBAR

BUNDLING

The bundling wires used for bundling shall be of at least 6mm size. As a minimum, the two end and middle bundling wires shall be doubled. Each bundling wire shall be spaced, depending on the length of the rebars, at intervals of approximately 1.7 to 2.2 meters, and at 0.5 meters from the ends. A 6-metre rebar bundle shall have a minimum of 4 bundling wires; a 9-metre bundle – a minimum of 5; a 12-metre bundle - a minimum of 7; and an 18-metre bundle - a minimum of 9. The two ends of the bundling wires shall be securely twisted at least four times to provide strength for tipping of the bundles. Proper and effective bundling helps with tip-lifting and maintains tight bundles of rebars, when handled with slings and forklifts.

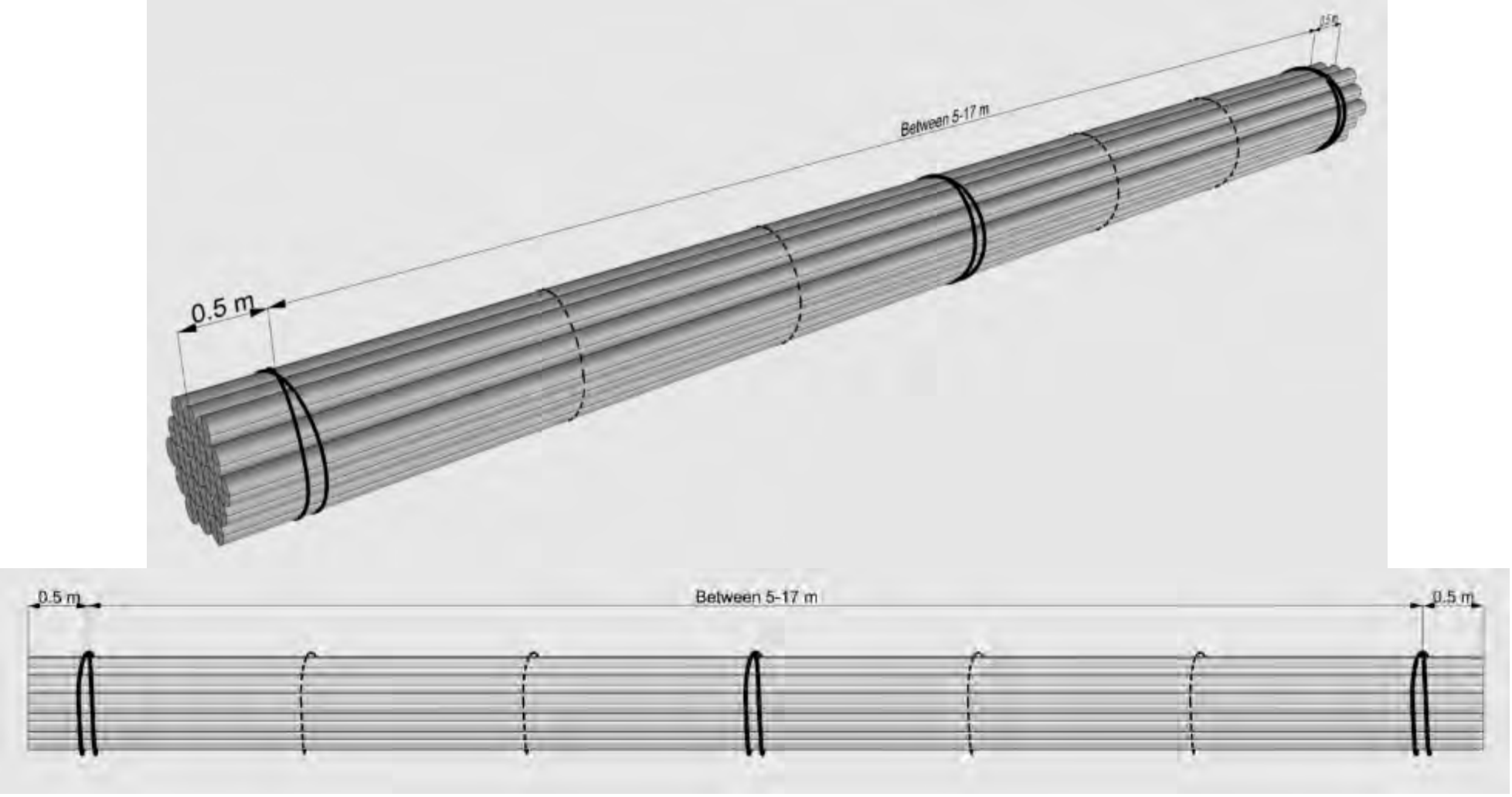


Double bundling wires used. Insufficient and incorrect securing twists. Minimum 4 twists required.



Double bundling wire schematics.

REBAR



Schematics for bundling rebars between 6 and 18 metres in length.
Three double bundling wires shall be made, one at 0.50 metres from both ends, and one in the middle.
The remaining bundles, as indicated by the dotted lines, need not be double and should be as required for the safe handling of the rebars.

REBAR

DUNNAGE

Steel cargoes tend to shift if not correctly dunnaged as there is very little friction between steel products laid directly atop each other. This is less evident with the deformed nature of rebar, however.

In accordance with industry good practice[4], good, dry, bark-free, hardwood dunnage shall be used at the tank-top and throughout the first six tiers of rebars. For the subsequent tiers, soft wood dunnage may be used.

Timber dunnage shall be laid athwartships on the tank-top prior to loading. Dunnage shall be spaced at intervals of no more than 3 meters; dunnage shall also be placed on hoppers and against bulkheads. Dunnage shall also be placed between this cargo and any adjacent cargo to assist with slinging during off-loading.

100mm x 100mm of hardwood dunnage shall be placed on the tank-top. 75mm x 75mm of hardwood timber dunnage shall be placed between the first six individual layers or tiers of rebar to facilitate discharge operations. Between the upper tier, soft wood dunnage may be used. The rebars shall be stowed in level tiers, not in a pyramid stow.

If the rebars within the area of the open hatches are pre-slung, dunnage will be required only for the rebars stowed in the under-coaming areas. Any nylon belts used for pre-slinging shall be clearly and permanently labelled with the SWL of the sling.

Loading of pre-slung rebars. The spacing of the tank-top dunnage should not exceed 3 meters. In the photograph, the spacing is approximately 2 meters.

[4] Lloyd's Practical Shipping Guides – Steel: Carriage By Sea, 5th Edition 2009 (A. Sparks & F. Coppers), and Thomas' Stowage

REBAR

Good, dry, hardwood shall be used when loading rebar.

Generally, 100mm x 100mm of square cross-section is preferred on the tank-top, and 75mm x 75mm through the stow.

REBAR

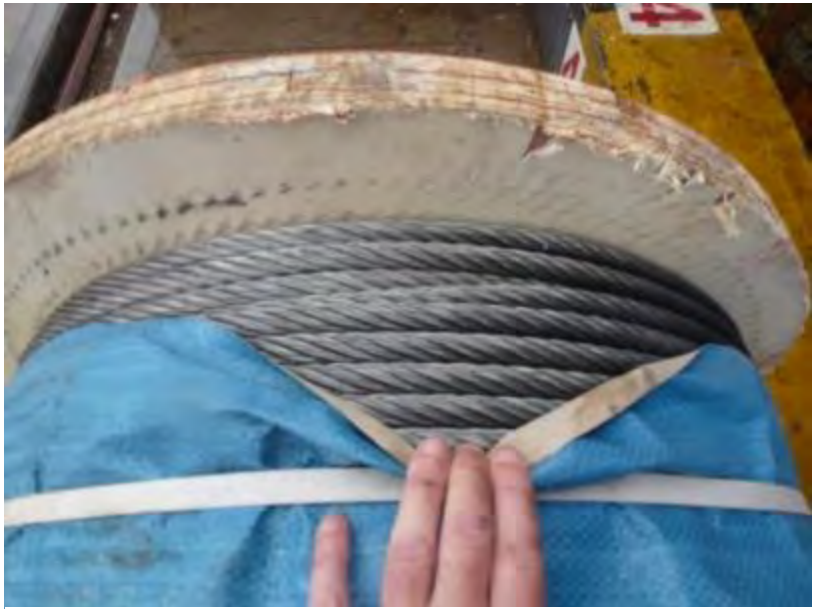
LASHINGS

All lashings shall conform with the requirements of the vessel's Cargo Securing Manual and the CSS Code.

When the cargo is stowed across the full width of the cargo hold, the rebar is prevented from shifting by the friction resistance of the timber dunnage and the confines of the cargo space. Wire lashings, bulldog grips and turnbuckles are used to secure the stow in a single block and prevent the initial movement of the bundles, particularly if the stow is not across the full width of the hold. All lashings shall be tight and well made. The Master shall be supplied with certificates for all lashing equipment used.

An appropriate number of lashing wires shall be laid in an athwartships direction on the tank-top in preparation for being passed back over the stow to secure the cargo in one block. There are no specific requirements for the minimum number of wires or chains to be used; however, a minimum of two per 6-metre length or a minimum of 3 per 12 meter length of bundle would be considered reasonable.

The American Club, in their publication "*Transport Guidance for Steel Cargoes*", consider that, for ease of use, 16mm (6x12) wire rope with bulldog grips, turnbuckles and shackles would normally be used to lash steel cargoes:



16mm wire rope supplied for lashing cargo.

Bulldog grips and additional 'D' rings for cargo lashings.

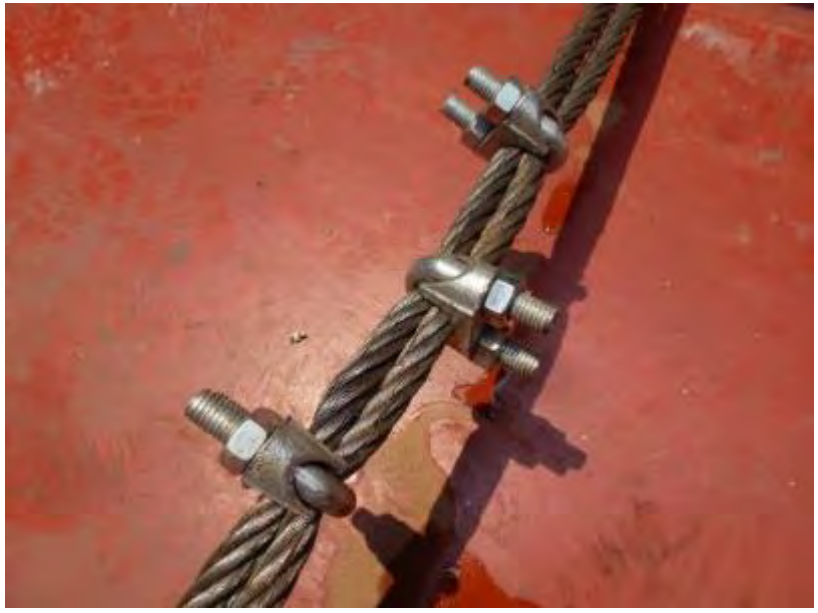
REBAR

For wires of up to 19mm diameter, a minimum of 3 bulldog grips shall be used at a spacing of approximately 6 times the diameter of the wire. The loose end shall be of length not less than 5 times the diameter of the wire. The grips saddle shall be on the live (load bearing) wire. The wires shall be tightened by rigging screws (UK P&I Club Best Practice: The Application of Bulldog Grips).

The publication Thomas' Stowage provides stricter guidelines with respect to the use of bulldog grips based on the size of the wires:

- 12-17mm diameter – 4 grips
- 18-24mm diameter – 5 grips
- 25+mm – 7 grips.

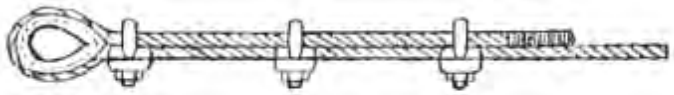
The bolts should be tightened sufficiently to compress the wire to $^{2}/_{3}$ of its nominal diameter. For lashing rebars, 3 bulldog grips are sufficient for a 16mm wire.



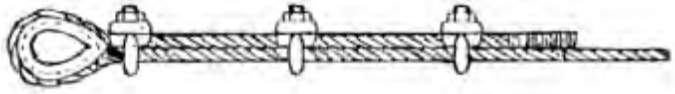
Incorrect way of using bulldog grips.

Incorrect way of connecting two wires and using bulldog grips. Insufficient number of grips used.

REBAR



Right way of applying bulldog grips



Wrong way of applying bulldog grips

Diameter of wire ropes (mm)	**Bulldog grips** (Number)
Up to and including 19	3
Over 19: up to and including 32	4
Over 32: up to and including 38	5
Over 38: up to and including 44	6
Over 44: up to and including 56	7

Minimum number of bulldog grips on the basis of the wire size.

Source: UK P and I Club. Lashing and Securing of Deck Cargoes by John R. Knott.

REBAR

STOWAGE

All cargo shall be stowed in accordance with the IMO Code of Safe Practice for Cargo Stowage and Securing (CSS Code).

Where there is more than one parcel for various consignees and multiple discharging ports, proper cargo segregation is required. This will allow for the remaining cargo to remain levelled and to be properly lashed and secured prior to the vessel's departure.

Steel is a heavy cargo, and the cargo hold tank-top loading limits shall be considered when loading. The maximum height of the stow will depend on the allowable load limit determined by the shipyard and confirmed by the Classification Society when the vessel was built. It shall be remembered that this limit was calculated when the vessel was new; for older ships, with normal wear and tear on the tank-top plating and associated under-deck stiffening, it is prudent to allow a safety margin.

Loading. A stow of rebar bundles, pre-slung with nylon slings to assist the discharge operation. Dunnage is also used between the tiers.

It is usual to stow bundles of rebar aligned in a fore-and-aft direction, across the full width of the cargo hold, although it may occasionally be partially stowed in the hatch square where different cargo has been loaded into the wing spaces.

It is not uncommon for alternate layers of rebar to be stowed athwartships, but care shall be taken to ensure that there is no steel-to-steel contact with the ship’s structures. An athwartship stow of rebars in combination with a fore-and-aft stow may be observed in the first and last cargo holds, where flaring of the hopper tank is a commont structural arrangement. The dunnaging of such a mixed stow will be difficult and challenging.

It is important to stow the ends of the bundles in a neat line as overhanging bundles can cause difficulties when discharging adjacent cargoes stowed in the same hold.

In the event of two separate stows of rebars in one cargo compartment, there shall be a minimum of 1 meter clearance between the forward and aft stow.

REBAR

Ports typically use Grade 100 chains, of 10-tonne SWL with a “choke hitch”. In this manner, they can handle six or seven bundles per lift of a maximum cumulative weight of approximately 14 tonnes.

If the bundles are tightly packed, with no slings pre-fitted, and there is no timber dunnage separating the tiers, smaller chains, or tipping hooks, are used to sufficiently “tip lift” the bundles to rig the lifting chains. This takes time and ultimately delays the discharge operation.

An application of the two-leg chain choke hitch around the bundles.

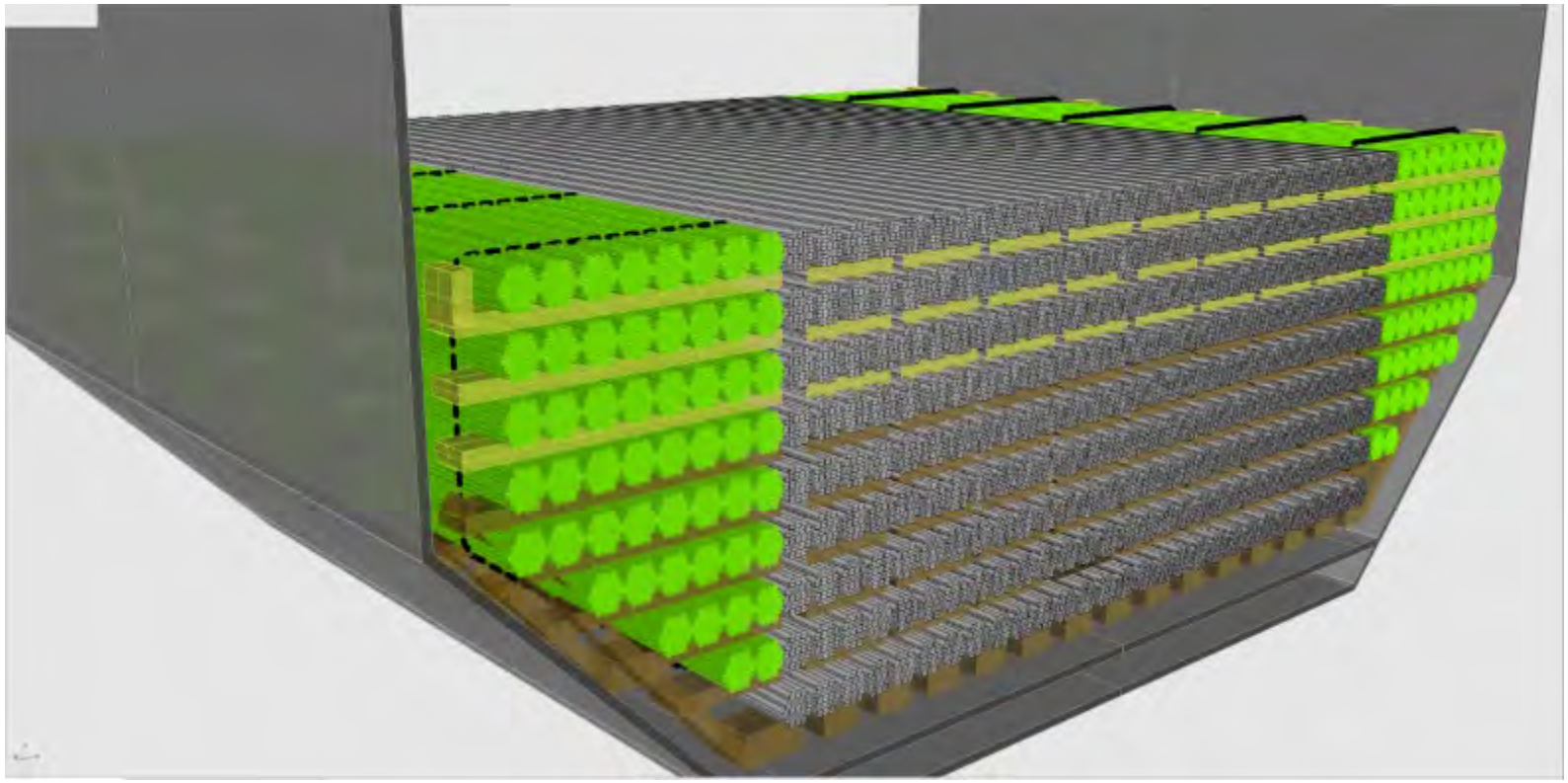
Tip-lifting technique used for off-loading rebars.

REBAR

SCHEMATICS FOR CORRECT STOWAGE, LASHING AND DUNNAGING

All schematics are indicative.

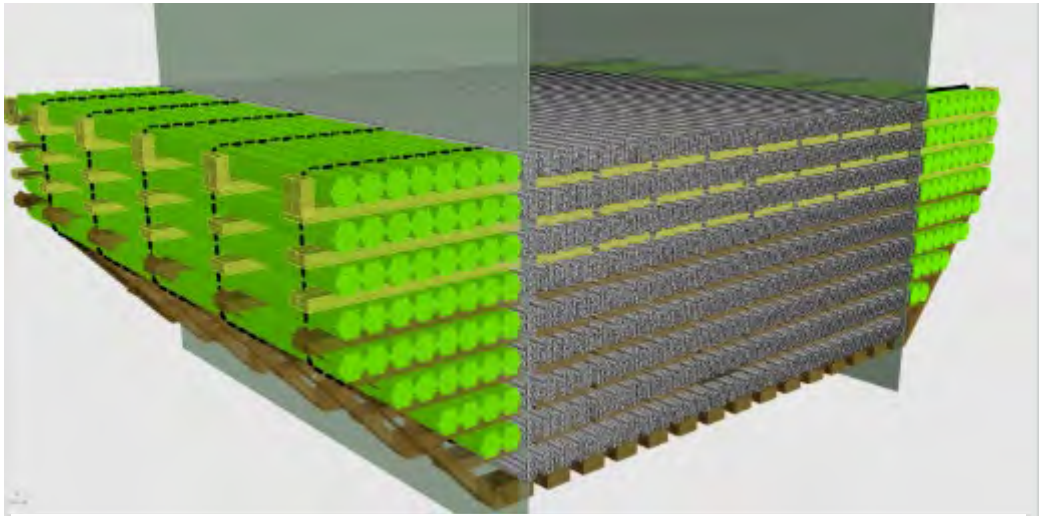
Schematics of the dunnage and lashing to be used for a stow of rebars. The first layer of tank-top dunnage shall be of size 100mm x 100mm. The subsequent 6-tiers of dunnage shall be hardwood of 75mm x 75mm. The dunnage for the subsequent higher tiers shall be of soft wood 60mm x 60mm. A minimum of two wires positioned on the tank-top and passed athwartships per 6-meter length or a minimum of 3 per 12 meter length of bundle would be considered reasonable.



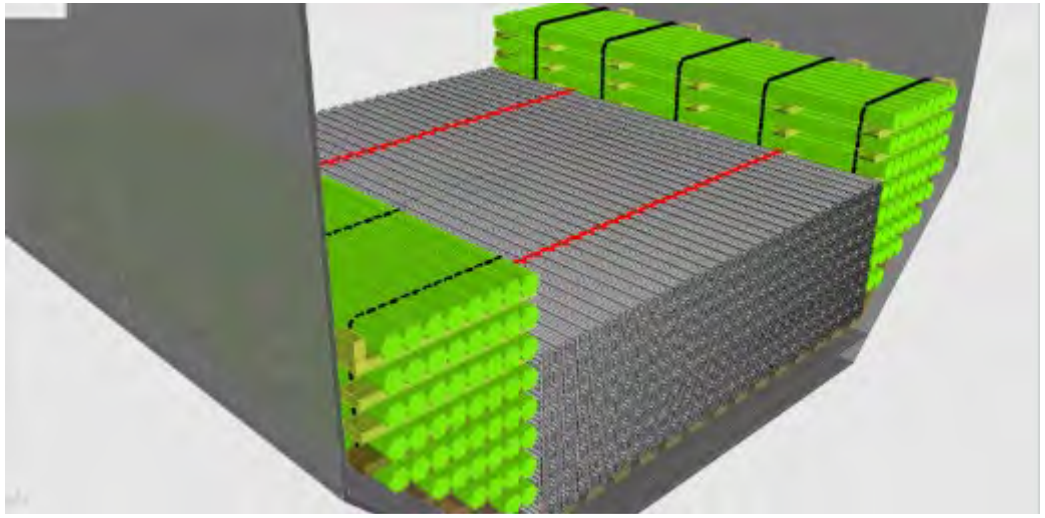
	Under-coaming stow
	Open hatch stow
	Soft wood dunnage
	Hardwood dunnage

REBAR

Schematics of rebars with the dunnage and lashing to be used for a stow of rebars.



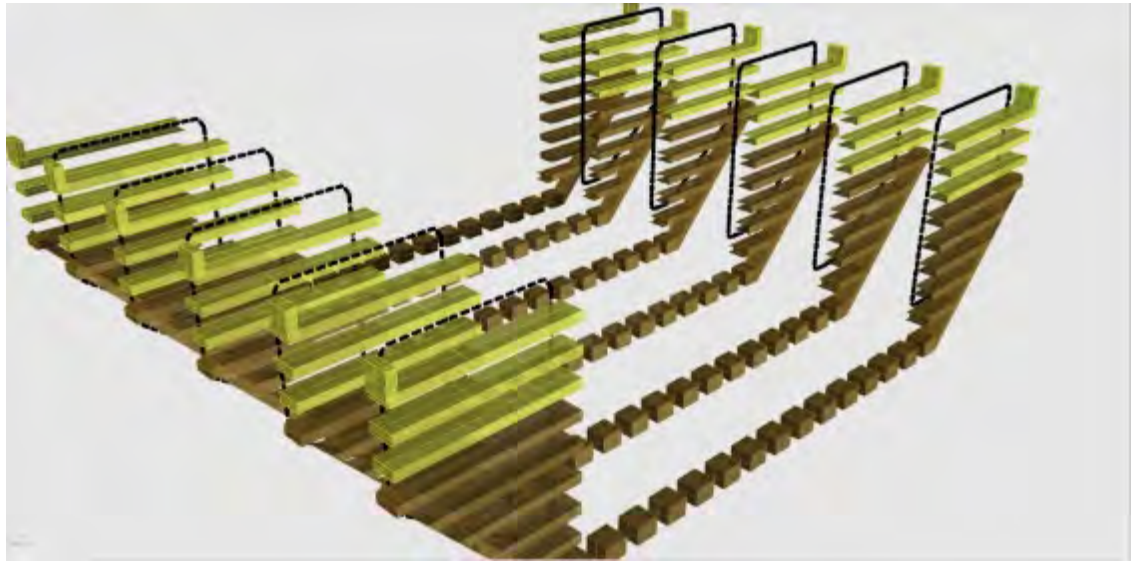
The under-coaming stow is lashed separately every 2 metres in height to prevent collapse of the stow during cargo handling.



The pre-slung stow under the open hatch is lashed separately and does not require dunnage except for the first tier to avoid contact with the tank top.

The separate lashing of the under-coaming stow is required to prevent collapse of the stow as a result of the vessel's movement when in transit.

Dunnage and lashing schematics for a stow of rebars. If the stow under the open hatch is pre-slung, dunnage may not be used for this part of the stow. Dunnage shall be used for the under-coaming stow.



	Under-coaming stow
	Open hatch stow
	Soft wood dunnage
	Hardwood dunnage

REBAR

UNDER-COAMING STOWAGE

All cargoes are off-loaded by vertical lift only. Ports may not use the lifting gear to drag cargo from the wing spaces to the open hatch square. To facilitate the off-loading of such cargo, forklift trucks are utilised.

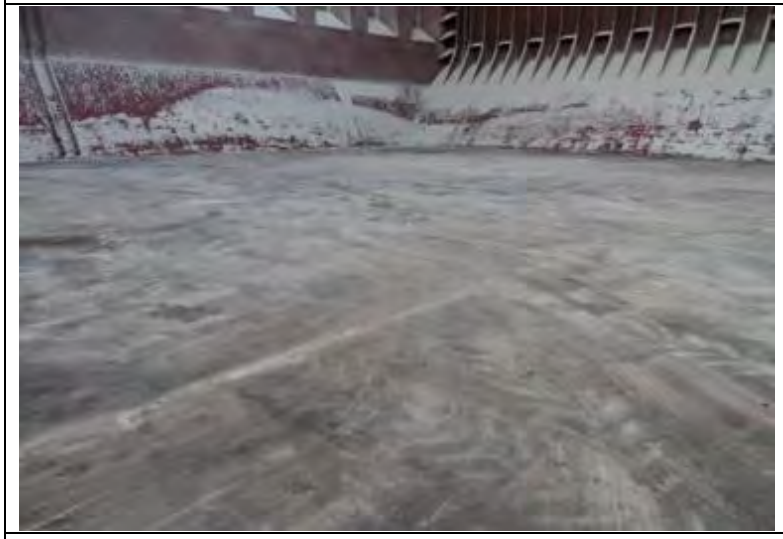
This requires that the bundles stowed under the wings are stable and well dunnaged between each tier. Rebars with a profile of less than 13mm shall not be stowed under the coamings.

Rebar stowed under the coamings by forklift trucks, prior to loading in the hatch square. Dunnage and lashing wires are pre-laid on the tank-top and additional dunnage between the subsequent tiers of rebar.

REBAR

A bulk carrier cargo hold in a clean condition ready for loading cargo.

A cargo ship with box-shaped cargo holds and pontoon 'tween deck ready for loading.

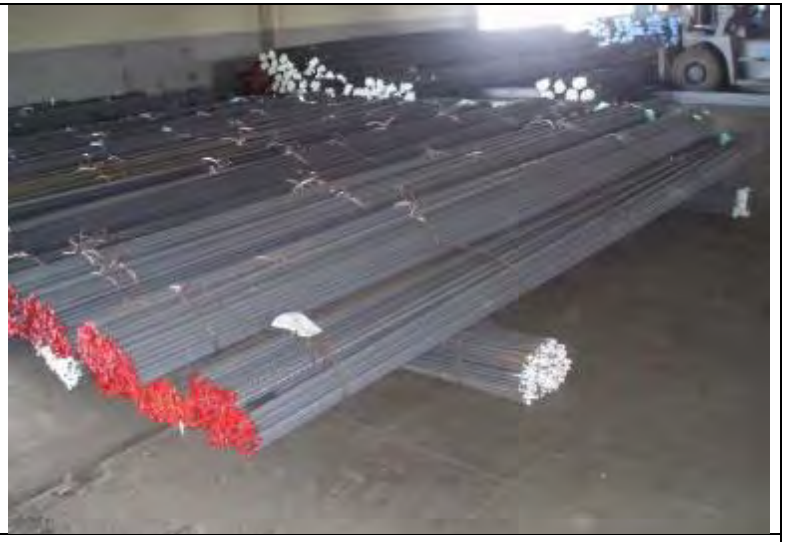


Poorly prepared cargo hold on a bulk carrier. Residue from some bulk cargoes can react with, and damage, the steel cargo.

Unprepared cargo hold on a bulk carrier. Residue from some cargoes can react with, and damage, the steel cargo.

REBAR

Rebar is often left in open yard storage where it will be potentially wetted with subsequent corrosion. Many receivers will not accept extensively corroded rebar.



Rebar stored inside a warehouse, protected from the elements. The majority of the stow is raised above any possible standing water.

Pre-slung 6m long bundles about to be loaded. Pre-slinging reduces the time needed for discharge operations.

Pre-slinging of two tiers of rebars in preparation for loading.

REBAR

A sling combining six bundles of rebars ready for loading.

The slings for pre-slinging shall be certified and properly marked.

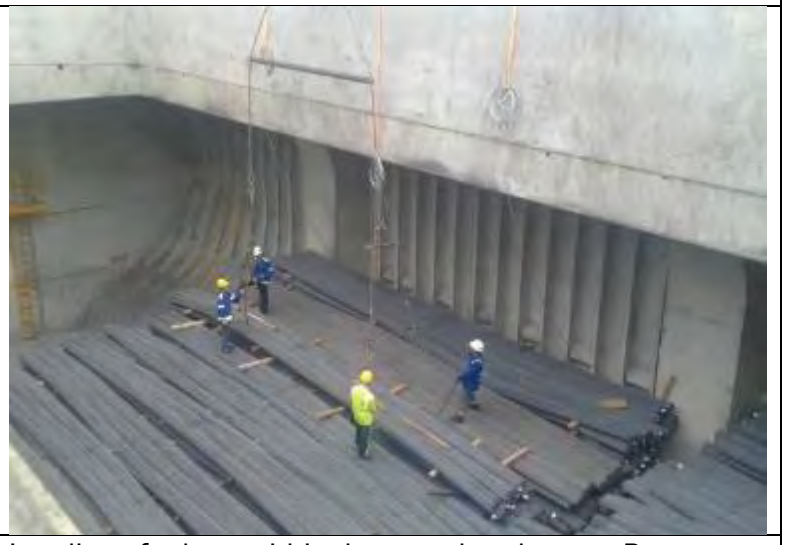
Lifting bundles by the bundling wires can lead to loosen bundles and/or broken straps, increasing the difficulty for discharge and the risk of damage.

The tank-top is prepared with dunnage prior to loading. Dunnage and lashing wires have been pre-laid. The first cargo is loaded in the under-coaming areas.

REBAR

The second stow also starts with the under-coaming spaces first. No pre-slinging was applied for the first stow. Dunnage is placed between the tiers.

When the cargo in the open hatch area is pre-slung, it is good practice to use also dunnage. However, dunnage is not required for this area when rebars are pre-slung, but only for the under-coaming areas.



Loading of rebars within the open hatch area. Proper use of dunnage. No pre-slinging is applied.

REBAR

Pre-slung rebar is often stowed athwartships due to the constraints of the space available for loading

Rebar stowed athwartships in the under-coaming area requires a forklift truck for it to be discharged. No pre-slinging and no dunnage between the tiers was used.

Pre-slung rebar is fanned out in way of the hopper tanks, but sufficient dunnage is placed on the hopper plating to prevent steel-on-steel contact.

75mm x 75mm section dunnage being laid between layers of rebar. The cargo is not pre-slung.

REBAR

The face of the stow shall be kept as level as possible. No dunnage was used between tiers. The rebars were not pre-slung to assist the off-loading. 1 meter clearance is required between the two stows.

Rebars stowed in an athwartships direction because of the higher tiers. The higher tiers are formed because of the tapered end due to the flaring of the hopper tanks.

If there is insufficient space for rebar, it is often preferable to stow other suitable cargo in way of the stool spaces. Good separation between the stows.

Lashings being tensioned on the completed stow.

REBAR

It is acceptable to stow other cargoes, pipes, steel plates, etc. on top of properly stowed and secured rebar as long it is not required to be re-stowed to allow discharge of the rebar.

Incorrect use of lashing wire. This usually occurs when the stow is not levelled.

Steel plates shall not be stowed atop rebars. Refer to the combined stow guidelines. However, rebars can be stowed on top of steel plates.

Rebar upon arrival at port, with well-positioned dunnage to ease the discharge operation, allowing for easy slinging of the bundles.

REBAR

Bad mixed stow of 12m long rebars without dunnage and pre-slinging. There is no clearance between the fore and aft stows with athwartships cargo stowed in between.

12m long rebars in the under-coaming space of a hopper-type bulk carrier. No dunnage. The stow is not levelled.

Shifted cargo at the discharging port. Bad pyramid stow of 12m long rebars without dunnage. Shifting of the rebars inside the under-coaming space.

Shifted cargo at the discharging port. Under-coaming sloped stow of rebars. The hopper tank flares out to the middle of the hold.

REBAR

Tipping hooks.

At the discharging port, tip-lifting causes operational delay and a risk of breaking the bundle straps.

Tip-lifting from the end of the rebars bundles.

Lifting the middle part of the rebar bundle with the use of a wire, to pass the choke hitch sling. The dunnage assists in passing the lifting wire.

Tip-lifting causes operational delay and a risk of breaking the bundle straps.

Once the lifting chains are in place, the short wires are removed.

REBAR

Once the lifting chains are attached, the bundles can be safely discharged.

If insufficient space is left between adjacent cargoes, discharge becomes very slow and damage to both cargoes is likely.

During off-loading, forklift trucks shall be used to access the under-coaming cargo. The dunnage assists in swift operation and damage prevention.

Under-coaming cargo of rebars. No dunnage and no pre-slinging. Difficult access to the upper tiers and handling by forklift trucks.

REBAR

Further down the stow, forklift trucks are used to assist with the slinging of the bundles, but, with no separation between the bundles, there is a risk of damage.

Broken wire bundling and damage to individual bars result from having to drag the bundles by forklift.

The bundles are then maneuvered into position for the stevedores to attach the slings.

Using a forklift truck to position the bundles under the hook.

Once off-loaded from the vessel, the rebars are handled by forklift trucks.

REBAR

SUMMARY CHECKLIST

- Tank-top load limits not to be exceeded. Consideration to be given to the hopper areas, where the load limits may be smaller.
- Tank-top to be prepared with appropriate dunnage to prevent steel-to-steel contact. Lashings to be pre-positioned on the tank-top.
- Maximum distance between rows of timber dunnage not to exceed 3 meters.
- Dunnage on the tank-top to be hardwood with minimum cross-section 100mm x 100mm.
- Dunnage between layers to be laid to assist with slinging at discharging ports.
- 75mm x 75mm hardwood dunnage for the first six tiers of rebars. For the subsequent tiers, soft wood dunnage may be used.
- Dunnage is required for the under-coaming space areas. If the rebars within the open hatch area are pre-slung, then dunnage is required only at the tank-top and not for the tiers.
- Separate lashing of the under-coaming cargo stow may be required to prevent the stow from collapsing during off-loading of the open hatch stowed cargo of rebars.
- All tiers to be stowed level, the face of the stow to be as straight as possible, with sufficient clearance from the adjacent stow to prevent virtual over stows.
- In the cargo compartments, where possible, safe passage shall be provided directly from the ladders to the top of the cargo stow. In bulk carriers, this access shall be provided directly from the Australian ladders. Safe access shall also be provided from the tank-top to the top of the cargo stow.

WIRE ROD IN COILS (WRIC)

GENERAL

Wire Rod in Coils (WRIC) are generally shipped in a semi-finished hot drawn condition with no external packaging; however, finished products such as galvanised wire rod may also be shipped. Finished products will be wrapped and protected to avoid damage by handling and moisture ingress.

WRIC comes in various sizes and grades; for example, an established UK steel manufacturer offers rod with diameters from 5.5-16.0mm, with coil weights ranging from 500-2,200kg. Coil lengths vary from 1,350-1,700mm with a maximum outside diameter of 1,250mm.

BUNDLING

WRIC, when unprotected, will be formed into bundles and usually secured with four steel wires or, occasionally, strapping bands. Finished, protected, coils will usually be secured into bundles by strapping bands. These securing wires or strapping bands are not designed for lifting and shall not be used for this purpose.

Each WRIC shall be bundled by five equally spread, double wires and not less. The bundling wires shall be secured by at least four twists. The use of five bundling wires will prevent the lower tiers of WRICs from crushing under and will keep the stow tighter without a risk of collapsing. If straps are used, then five bundles shall be made as well.

Each bundling wire shall be at least of 6mm diameter.

Bundling of WRICs with the use of double bundling wire rods and four twists.

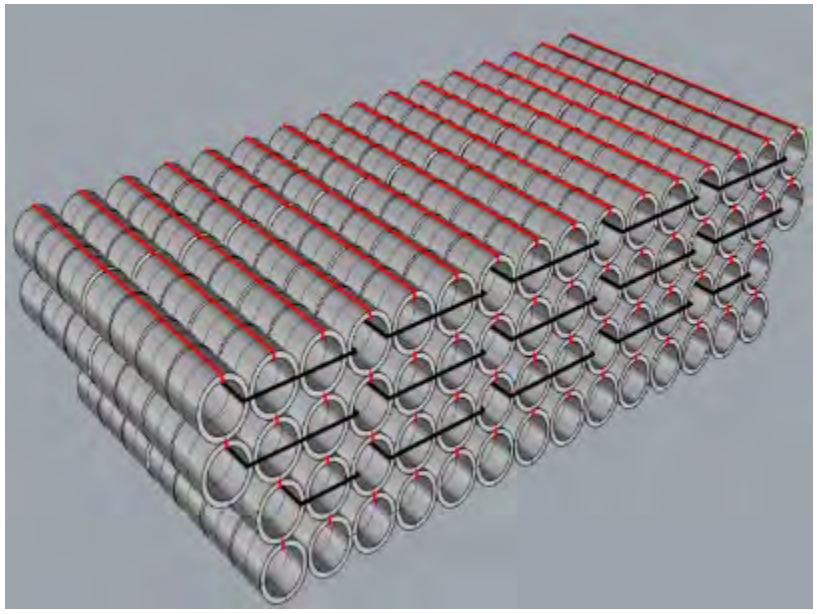
WIRE ROD IN COILS (WRIC)

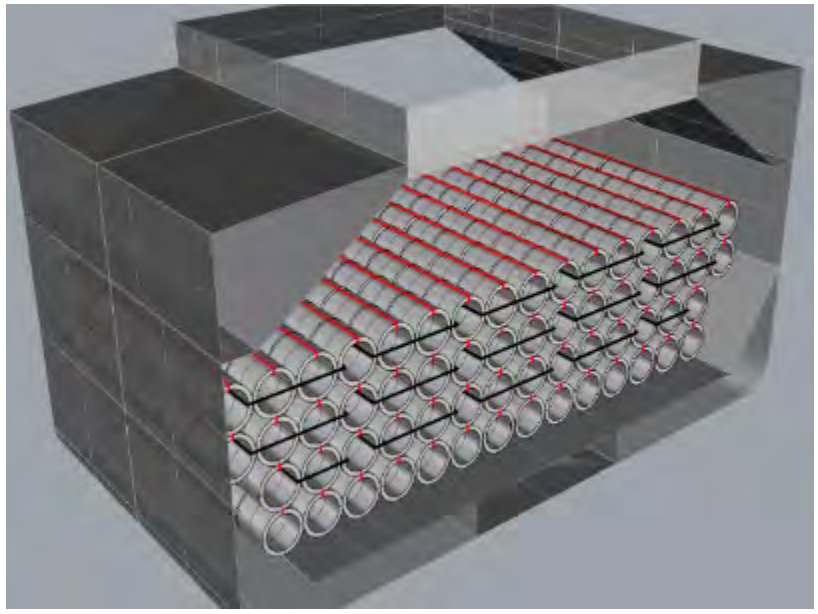
Partially protected WRIC secured with strapping bands. The outer canvas/plastic cover offers some protection from the elements.

Fully protected galvanised WRIC, bundled with four strapping bands.

WIRE ROD IN COILS (WRIC)

WRICs shall be bundled with five bundling wire rods of minimum 6mm size. Each bundling wire shall be doubled.





Prior to loading, each individual wire rod coil from the stow is required to be pre-slung for safe off-loading operation at Jurong Port. The red marks in the schematics above indicate the slings and the black marks indicate the lashing of the coils.

WIRE ROD IN COILS (WRIC)

DUNNAGE

The lower tier of WRICs on the tank-top or 'tween deck shall be stowed on plywood dunnage sheets, to prevent steel-to-steel contact with the ship's structure. The size of the plywood dunnage shall be with thickness of approximately 10mm. The plywood shall cover fully the tank-top. Similarly, timber dunnage or plywood sheets shall be used on hoppers, in way of side frames or vertical bulkheads. When using timber planks for the hoppers or the vertical bulkheads, a minimum of two lines per row of coils shall be used.

The dunnage placed on the tank-top shall be plywood (and not planks as indicated in the photograph).

If the coils are resting against side frames, care shall be taken to ensure that the load on the coils is spread evenly along the length to avoid the coil deforming around the frames. This is particularly relevant on the lower tiers, where the weight of the upper tiers pushing down leads to a greater outward force on the coils at the outboard ends of the stow.

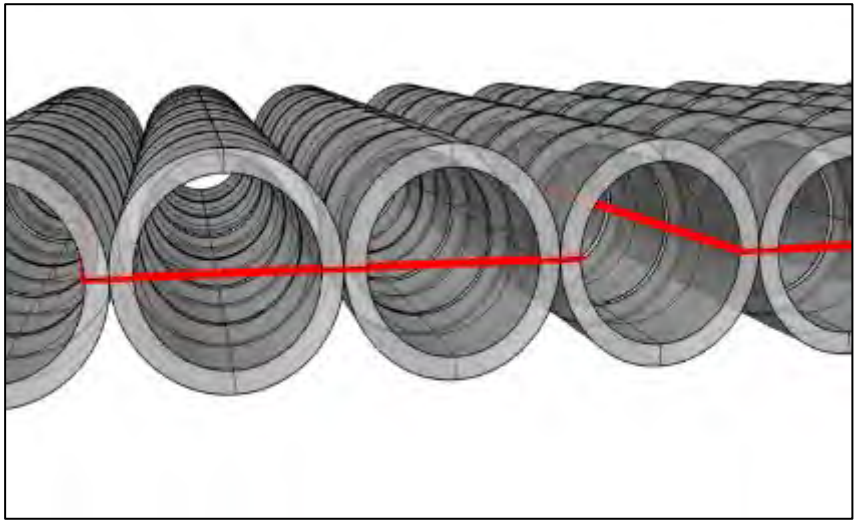
WIRE ROD IN COILS (WRIC)

LASHINGS

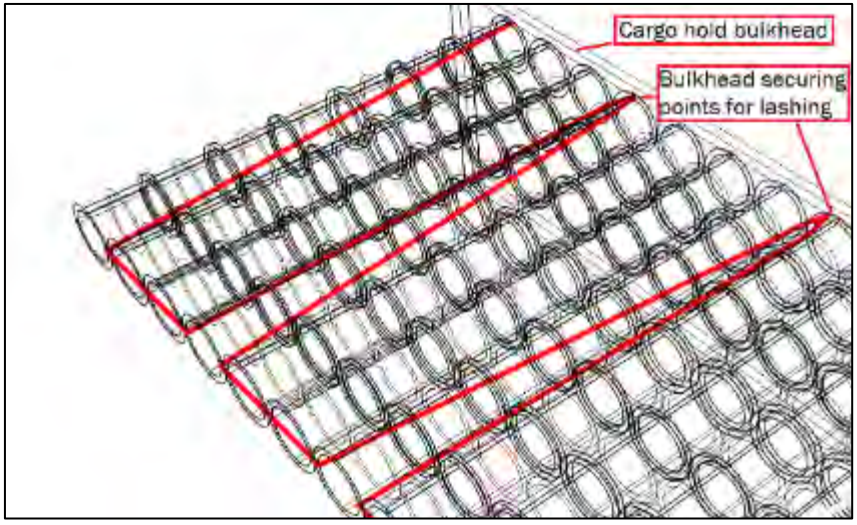
If the cargo is stowed homogeneously throughout the full width and length of the cargo hold, usually no lashing will be necessary. If the cargo only fills part of the hold and has an open face, then the coils in the upper tiers will require to be secured.

If loading less than a full hold, each tier of the WRIC stow shall be secured with the use of wire lashings to the aft or forward bulkheads in the following manner:

1. The WRICs stow shall preferably be loaded in the aft part of the cargo hold and the aft bulkhead shall be used for securing of the lashing wires.
2. Appropriate lashing points shall be prepared on the bulkheads so that the lashing wires are not secured to structural components of the bulkheads. D-shackles and rims shall be used. These shall be properly welded, and their condition inspected and verified.
3. The lashing wires shall be run through every third or fourth coil from a tier and secured to the bulkhead, as indicated in the photographs below and the section with the schematics. This method of securing is particularly important for high stows of WRICs.
4. Strapping bands shall not be used for lashing and securing to the vessels' bulkheads.
5. The lashing wires shall be equally tended to prevent the stow of WRICs from shifting during passage and discharging.



Lashing and securing arrangement of one tier of WRICs to the bulkhead. A view from the front.



Lashing and securing arrangement of one tier of WRICs. A view from the top showing the securing points on the bulkhead.

WIRE ROD IN COILS (WRIC)

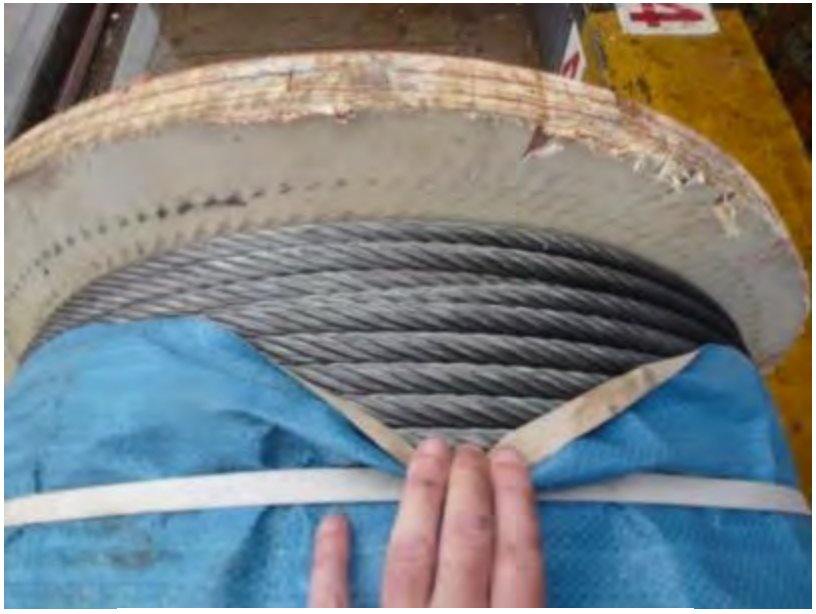
The tiers of the stow have been lashed back with wires to the after bulkhead. The height of this stow is significant.

The WRIC tiers in the tween deck are lashed with steel bands. Steel bands are not elastic and cannot be secured to the vessels' bulkheads. Wire lashings shall be used instead.

For ease of handling, 16mm (6x12) wire rope is considered suitable for lashing. The upper tiers shall be secured by wires; lower tiers may be looped together using nylon strapping.

WIRE ROD IN COILS (WRIC)

The American Club, in their publication "*Transport Guidance for Steel Cargoes*", consider that, for ease of use, 16mm (6x12) wire rope with bulldog clips, turnbuckles and shackles would normally be used to lash steel cargoes:



16mm wire rope supplied for lashing cargo.

Bulldog grips and additional 'D' rings for cargo lashings.

WIRE ROD IN COILS (WRIC)

For wires of up to 19mm diameter, a minimum of 3 bulldog grips shall be used at a spacing of approximately 6 times the diameter of the wire. The loose end shall be of length approximately 5 times the diameter of the wire. The grips saddles shall be on the live (load bearing) wire. The wire lashing shall be tightened with the use of rigging screws or turnbuckles. (UK P&I Club Best Practice: The Application Of Bulldog Grips).

The publication Thomas' Stowage provides stricter guidelines with respect to the use of bulldog grips based on the size of the wires:

- 12-17mm diameter – 4 grips
- 18-24mm diameter – 5 grips
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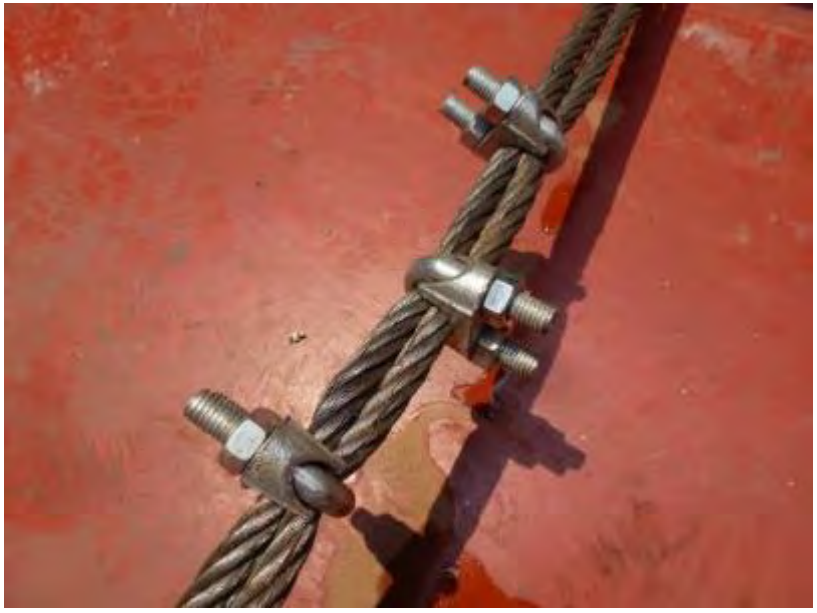
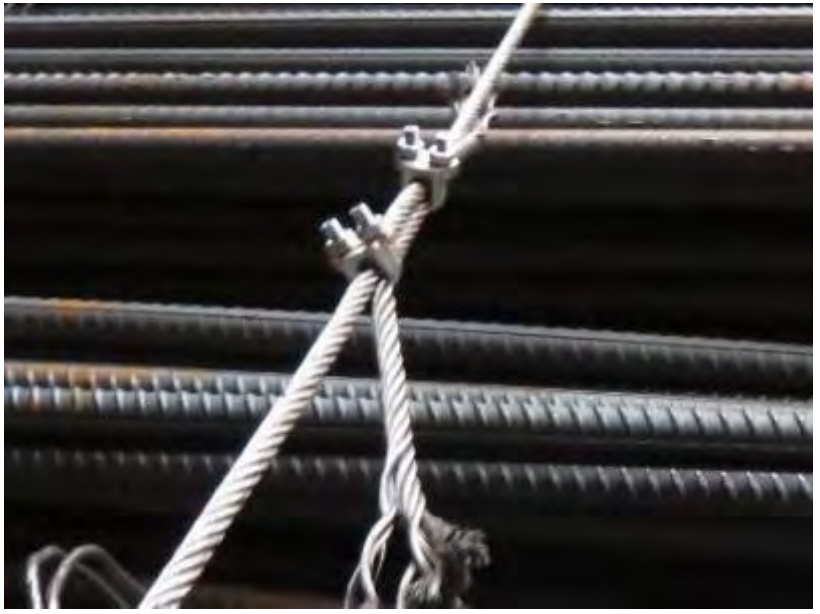
The bolts should be tightened sufficiently to compress the wire to $^{2}/_{3}$ of its nominal diameter. For lashing WRICs, 3 bulldog grips are considered to be sufficient for a 16mm wire.

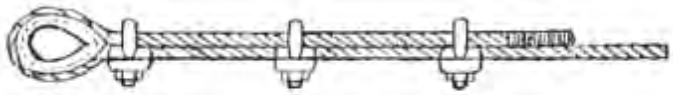


Incorrect way of using bulldog grips.

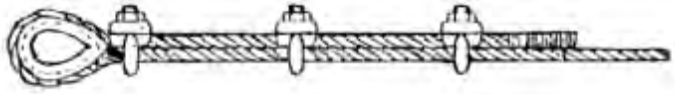


Incorrect way of using bulldog grips with grips on the live wire. Insufficient number of grips used.

WIRE ROD IN COILS (WRIC)



Right way of applying bulldog grips



Wrong way of applying bulldog grips

Diameter of wire ropes (mm)	**Bulldog grips** (Number)
Up to and including 19	3
Over 19: up to and including 32	4
Over 32: up to and including 38	5
Over 38: up to and including 44	6
Over 44: up to and including 56	7

Minimum number of bulldog grips on the basis of the wire size.

Source: UK P and I Club. Lashing and Securing of Deck Cargoes by John R. Knott.

WIRE ROD IN COILS (WRIC)

STOWAGE

All cargo shall be stowed in accordance with the IMO Code of Safe Practice for Cargo Stowage and Securing (CSS Code).

Coils are generally stowed with the axis in a fore-and-aft direction, although they may be stowed athwartships under the large wing spaces on bulk carriers to facilitate discharge. According to the industry accepted publication Thomas' Stowage[5] WRIC shall be stowed across the full width of the cargo hold and arranged so that the coils are tightly and compactly stowed.

The manufacturer shall provide their recommended approved stowage with respect to the maximum level of the stow and number of tiers.

Prior to or during the loading operation, all WRICs from stow, are required to be individually pre-slung for safe and efficient off-loading at port.

Compact, rigid WRICs are vital to effect a good stow. With their higher-than-normal stowage factor, WRICs can be stowed on either the tank-top or on the 'tween deck if required. The stowage shall be uniform and compactly arranged to avoid breakdown of the stow and subsequent crushing and/or disintegration of the bundles. Coils shall be handled with care to prevent "nicking", scoring, scratching, localised sharp bends and/or twists to the windings.

WRIC being stowed across the full width of a box- shaped cargo hold.

WRIC loaded in the 'tween deck space. The lashing gang are securing the top tier of the face of the stow.

If the coils are of different sizes, the largest coils shall be stowed in the lower tiers. Similarly, slack coils shall not be placed in the lower tiers.

[5] Thomas' Stowage, 7th Edition 2016, Brown, Son & Ferguson, Ltd, Glasgow.

WIRE ROD IN COILS (WRIC)

Use more dunnage if necessary to level the stow and/or fill in any gaps. Each lower-tier coil shall rest against another or the adjacent bulkhead. The maximum number of coil tiers is subject to several factors, including: the weight of the coils, the rigidity of the coil structure and the proper stowage of the coils. Written advice shall be sought from the shipper/manufacturer of the coils if in doubt. Prior to the loading, confirmation shall be sought and obtained, from the manufacturer, of the maximum allowed number of tiers in one stow. If such advice is not provided, the stow shall not normally exceed 8 tiers.

Wire coils may be stowed atop other steel cargoes (plate, pipe, section, H-beam, etc.) but shall not be over-stowed by other cargo as WRICs themselves can easily be deformed.

Tiers shall ideally be staggered to avoid a vertical face; the face shall never overhang. If the coils are not staggered, two lengths of dunnage placed in the cantlines bridging two rows of coils will, when over-stowed, help to bind the rows together.

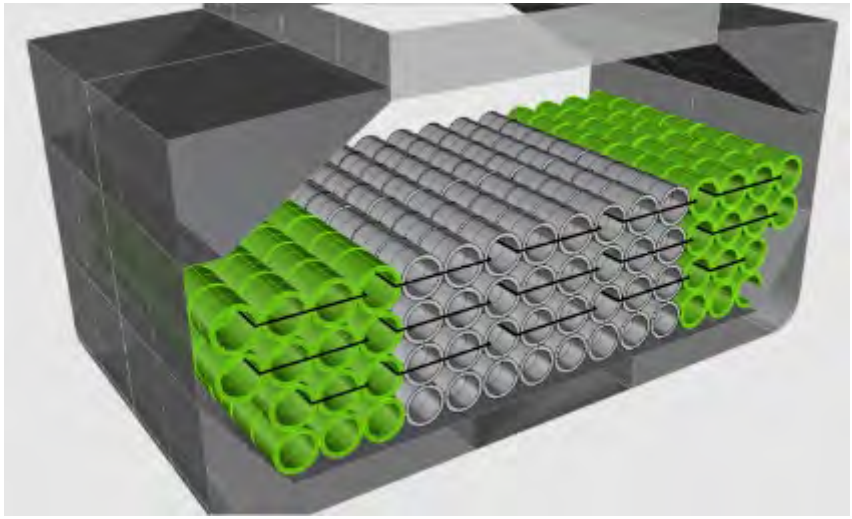
When the stow is not spread across the whole tank-top, but loaded with other cargoes, a high stow of wire rod coils is recommended to be loaded in the aft part of the hold, to prevent a possible collapse in the event of excessive stern trim of the vessel. When the cargo is part loaded in the hold, with a high vertical face, the coils at the forward edge of the stow shall be pre-slung and each tier additionally secured with lashing to the bulkhead. This is for stevedore safety as it reduces the risks involved in trying to pass lifting wires or strops through these coils.

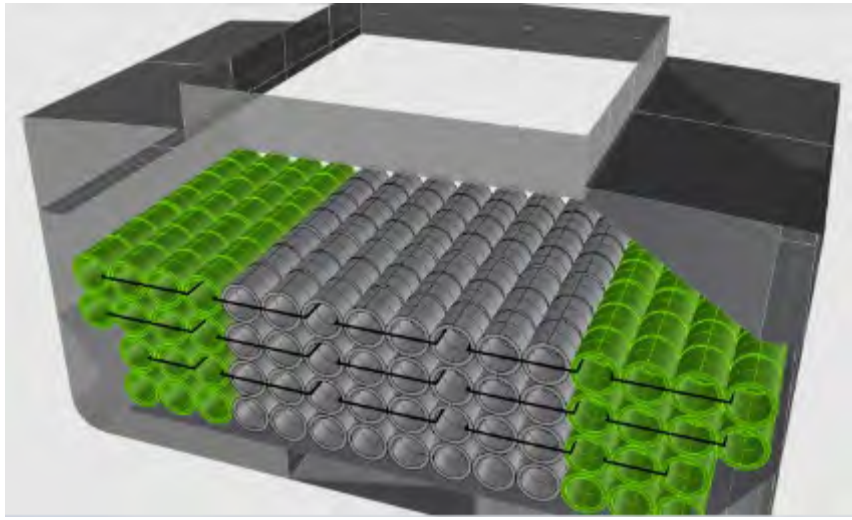
WRICs loaded on top of rebars segregated with plastic sheets.

Staggered and lashed upper tiers of WRICs.

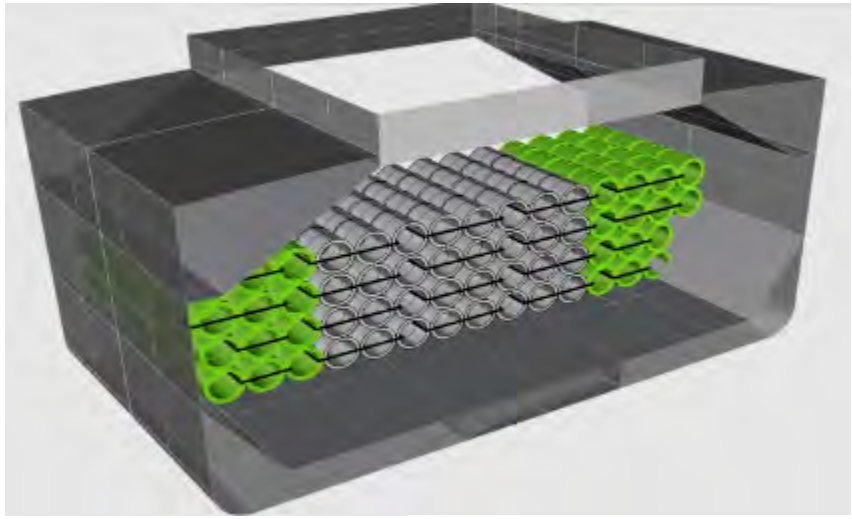
WIRE ROD IN COILS (WRIC)

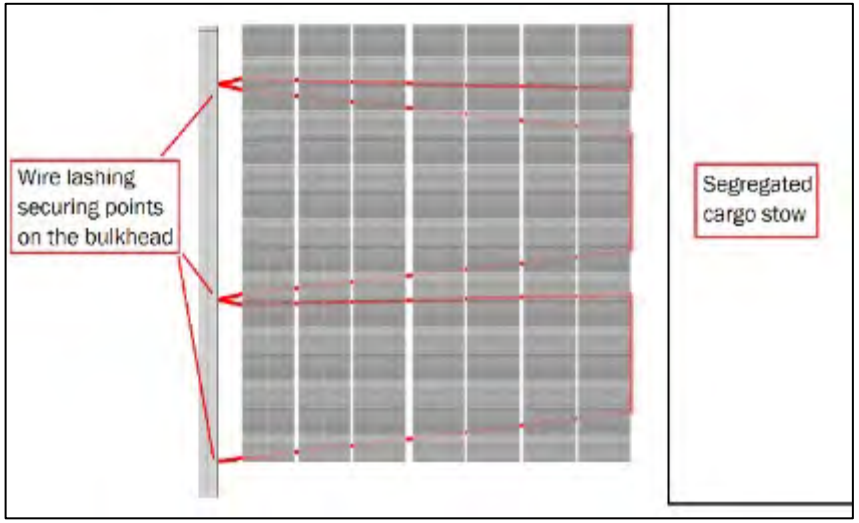
SCHEMATICS FOR CORRECT STOWAGE AND LASHING (the pre-slinging is not indicated in these schematics)





Fully loaded cargo hold. The under-coaming coils shall be lashed separately from the open hatch cargo stow.
Lashing of WRICs is normally not required for a full stow. The top three tiers may be lashed to prevent possible shifting.





	Under-coaming stow
	Open hatch stow

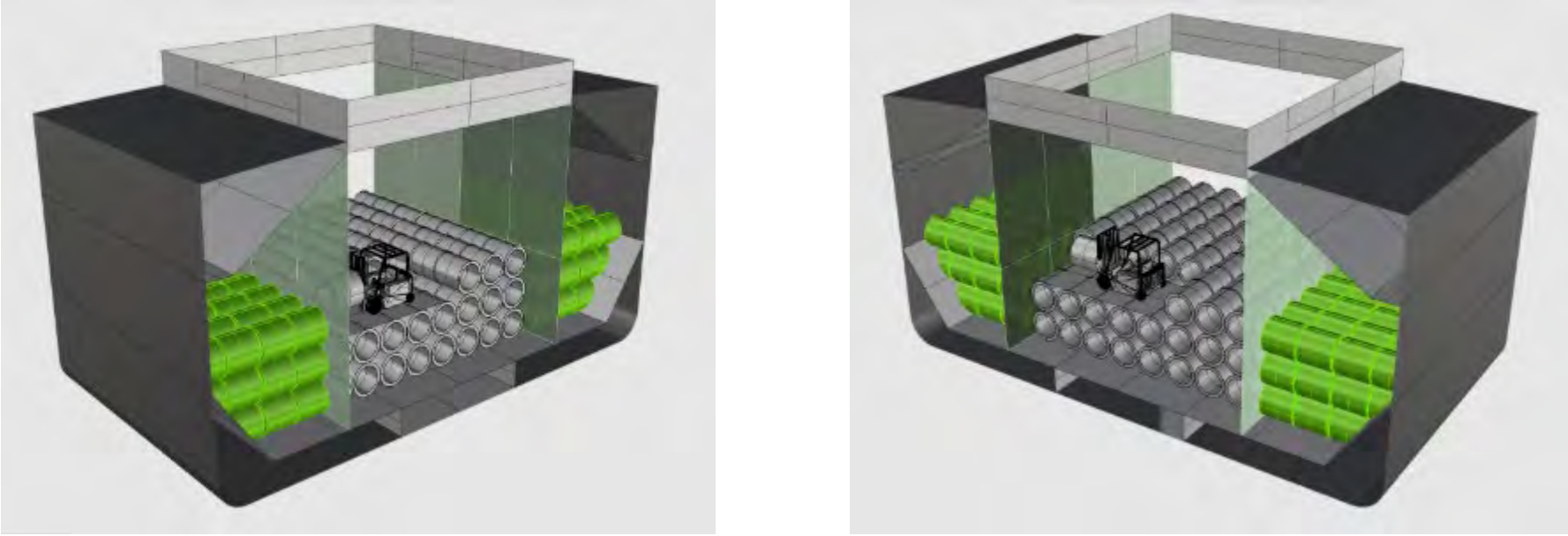
Partly loaded cargo hold. The tiers of WRICs shall be lashed in a group. The lashing wires shall be run through the third or fourth coils and secured to the bulkhead. Ideally, all tiers from the tank-top should be lashed.

WIRE ROD IN COILS (WRIC)

UNDER-COAMING STOWAGE

For a homogeneous cargo loaded throughout the cargo hold in bulk carriers, WRICs stowed under the coamings cannot be directly lifted out from the hatch square. These WRICs need to be pulled into the hatch square using light forklift trucks, maneuvering on steel plates placed over the coils stowed in the hatch square, layer by layer. For WRICs stowed with the axis in a fore-and-aft direction, there is no direct lift for the forklift trucks and the possibility of damaging the cargo is increased.

To limit the potential damage to the WRICs, and in order to ease the off-loading operations, it is recommended that the WRICs in the under-coaming spaces are stowed with the axis in a transverse direction as shown in the schematics below.



Suggested stow for wire rod coils on bulk carriers with hopper-type cargo compartments.
Note: vertical shadow is for plumb-line reference only.

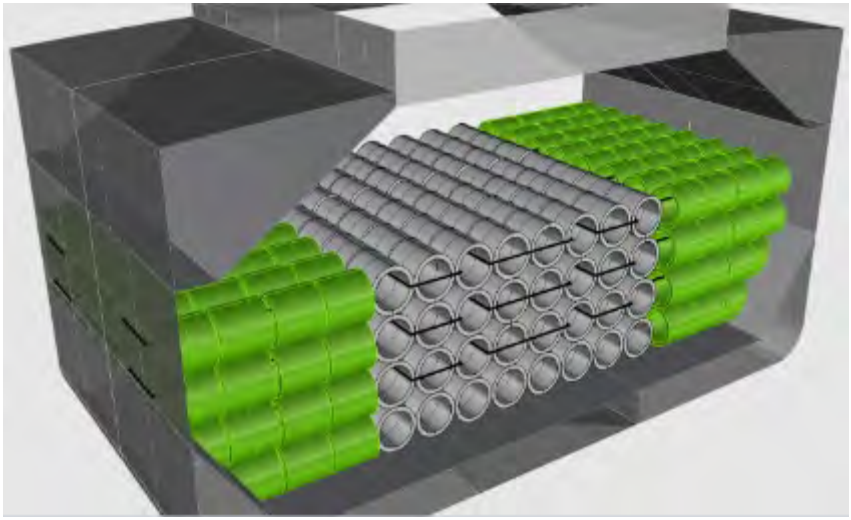
	Under-coaming stow
	Open hatch stow

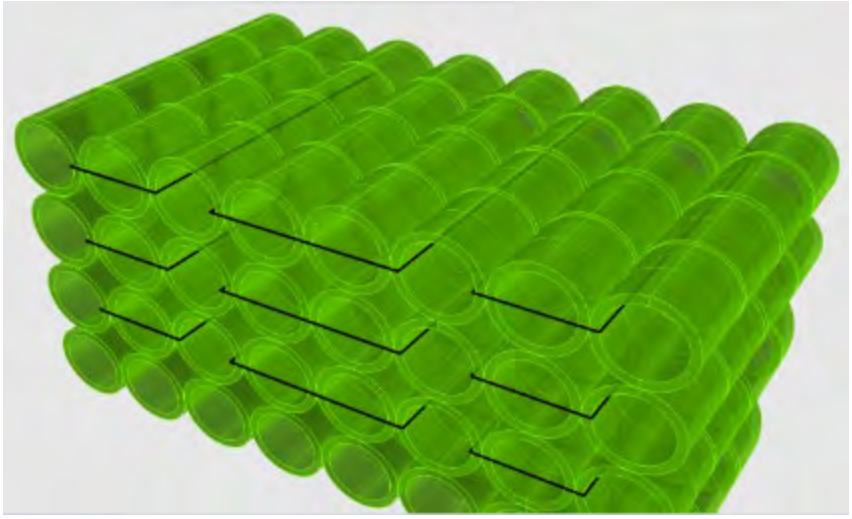
WIRE ROD IN COILS (WRIC)

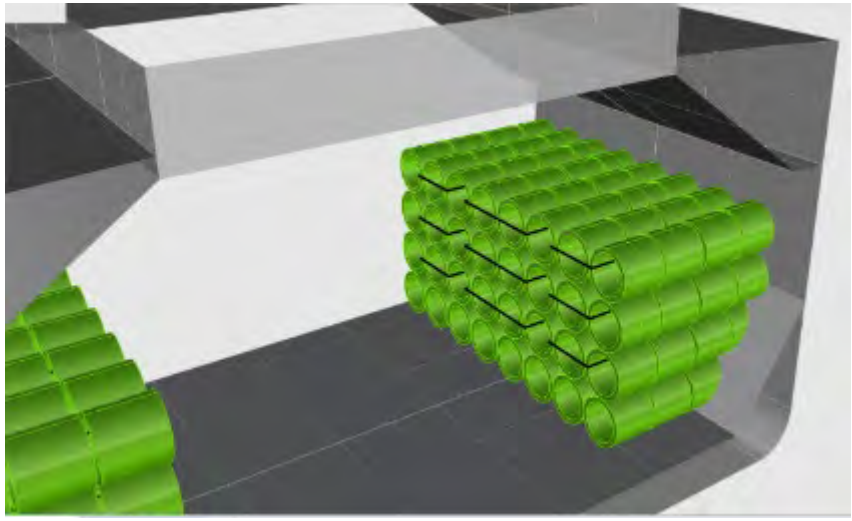
Under-coaming WRICs loaded in an athwartships direction. In this scenario, the WRICs stow under the coaming shall be lashed separately from the stow under the open hatch.

The usual group lashing is to be applied by lashing in a group three to four side coils from the rows together. The top three tiers shall be lashed in this way. The lashing wires shall be secured to a bulkhead.

The stow under the open hatch may not be lashed, if the stow extends to the full surface of the tank-top. However, to provide a rigid stow, the top three tiers shall be lashed in a group of three or four.







	Under-coaming stow
	Open hatch stow

WIRE ROD IN COILS (WRIC)

A bulk carrier cargo hold in a clean condition ready for loading cargo.

A cargo ship with box-shaped cargo holds and pontoon 'tween deck ready for loading.

Poorly prepared cargo hold on a bulk carrier. Residue from some bulk cargoes can react with, and damage, the steel cargo.

Unprepared cargo hold on a bulk carrier. Residue from some cargoes can react with, and damage, the steel cargo.

WIRE ROD IN COILS (WRIC)

Rust-covered, unprotected coils in open storage. The coils are damaged, and the securing bands are loose. These coils will not make a tight and secure stow.

Unprotected coils in open storage before loading. Note the unwound coil highlighted in yellow. Such WRICs shall not be accepted for loading.

Unprotected coils brought to the vessel by trailer. Only four single wire rod bundles are applied.

Covered coils brought to the vessel for loading.

WIRE ROD IN COILS (WRIC)

Slinging the coils for loading. One nylon belt per coil is used to avoid damage to the cargo.

By using lifting strops attached to beams (spreader), up to six coils at a time may be loaded in this layout.

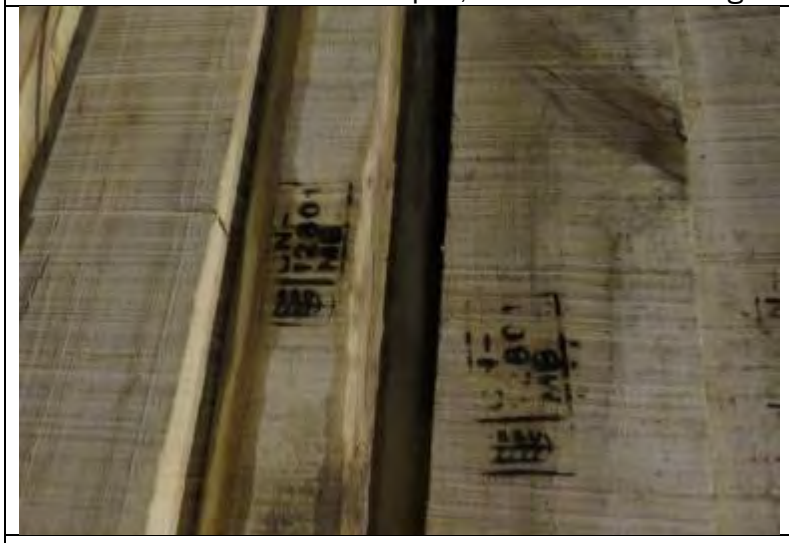
In this set-up, eight coils are loaded; however, the slings are made of wire. This is not recommended as it may damage the coils or their securing straps/wires.

Poor loading practice. Coils landed directly onto a tank-top covered with previous cargo residues. The cargo residues may react with the steel.

WIRE ROD IN COILS (WRIC)

The coils are landed in the hatch square before being positioned in the under-deck areas by forklift truck. The WRICs are loose and will collapse, when stowed in height.

Timber dunnage on the tank-top/'tween deck is positioned on the tank-top. Plywood dunnage sheets are required.



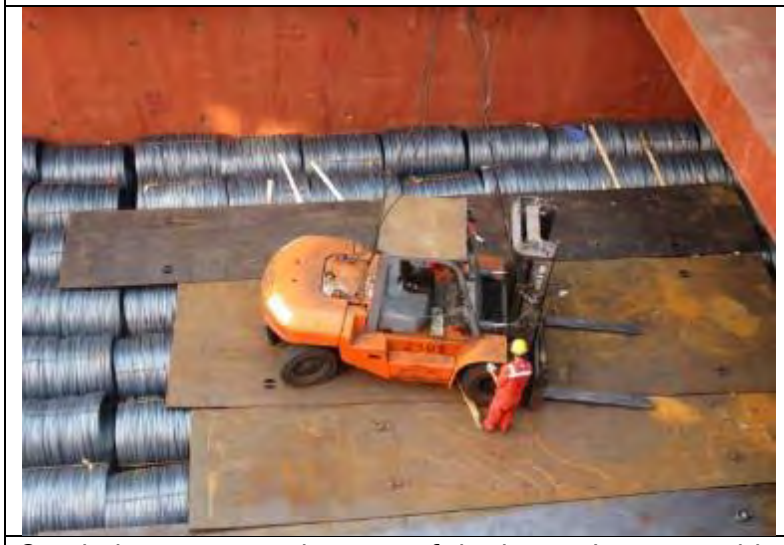
Plank-type, timber dunnage for WRIC. 15x100mm cross-section is a typical size. The dunnage in the photograph bears the ISPM15 stamp. This dunnage is to be used for the bulkheads only, and not tank-top.

No plywood dunnage under the coils. The bottom of the coil is in direct contact with the tank-top. Any moisture collecting on the tank-top will directly affect the coils.

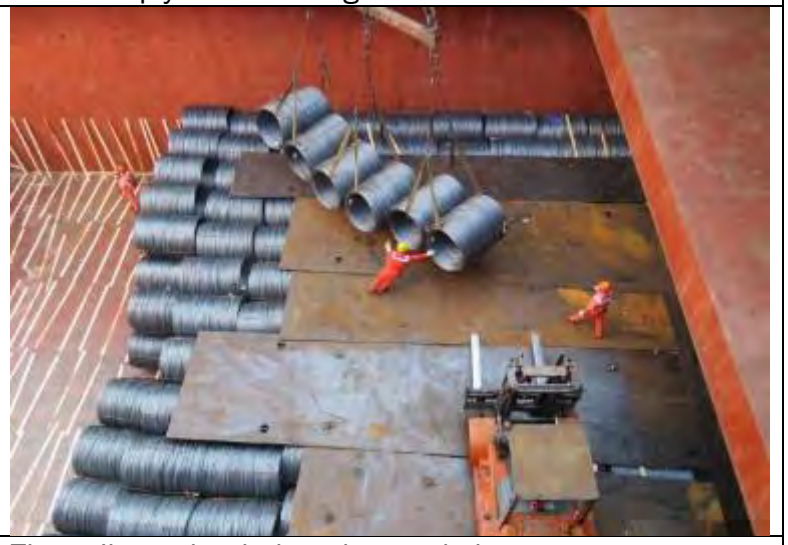
WIRE ROD IN COILS (WRIC)

No timber dunnage between the coils and the cargo hold bulkhead. Only four wire bundles in use instead of five.

After the under-coaming areas are stowed, the coils are loaded into the hatch square, and forklift trucks are used to ensure that the coils are tightly stowed across the hold. No plywood dunnage is used.



Steel plates are used on top of the lower tiers to enable a forklift truck to stow the upper tiers under the coaming area.



The coils are landed on the steel plate...

WIRE ROD IN COILS (WRIC)

...and positioned under the deck area.

Near completion, the coils are stowed directly into position. This often leads to poor stowage. The above shows a row of coils that has partially collapsed.

These coils have been randomly stowed and will be time-consuming to off-load. Crew supervision is essential to stop this standard of loading.

Collapsed stow of WRICs.

WIRE ROD IN COILS (WRIC)

Unwound and damaged coils. These shall not have been loaded as they may be rejected by the receivers and will be difficult and dangerous to off-load.

The stow of coils is not tight across the hold due to the unwound coils.

One coil has fallen off the stow and is sitting vertically, and unsecured.

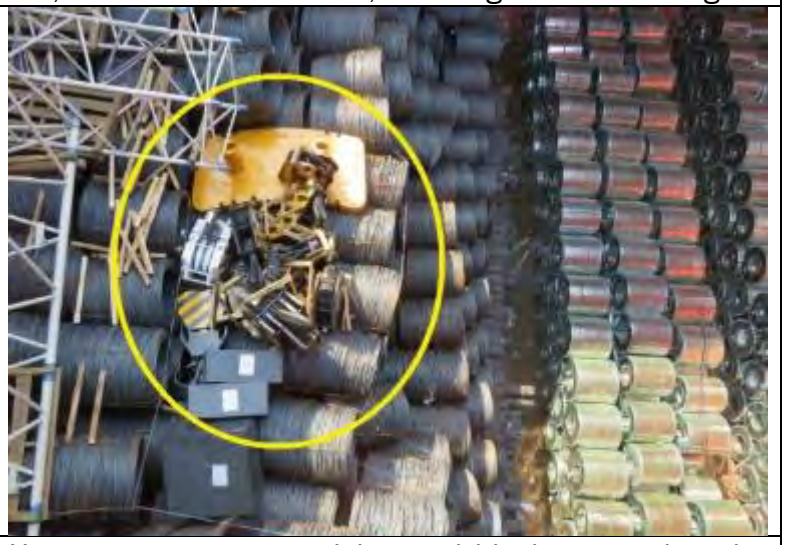
Poorly stowed outer coils in a bulk carrier. Although the tiers are lashed, the outboard coils are leaning forward and will likely collapse on the voyage.

WIRE ROD IN COILS (WRIC)

No timber dunnage between the sloping plate and the coils. Steel-to-steel contact means there is no friction to restrict the outer coil from moving forward.

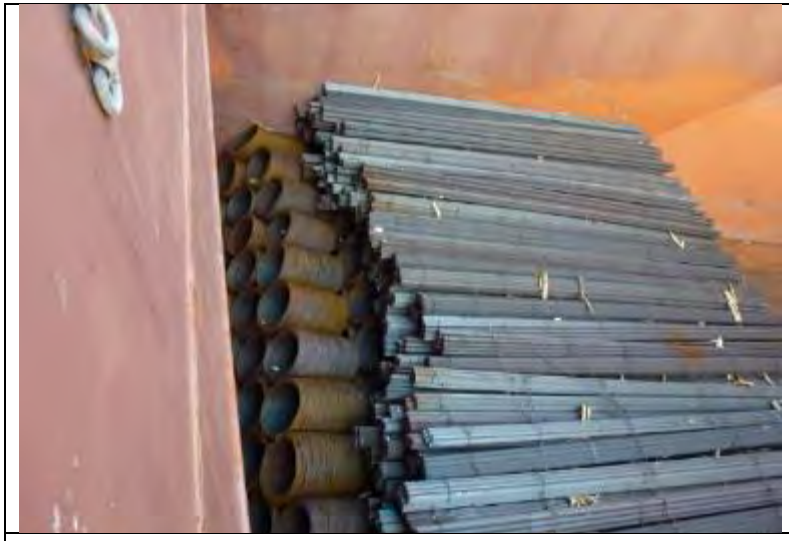
Cargo stowed above WRIC, which shall not be considered. In addition, the lashings for this cargo are attached directly to the wire rod. The hook will either fall out, or deform the wire rod, resulting in loose lashings.

Cargo stowed above a high, loose, stow of WRIC. The face of the stow is in imminent danger of collapsing. The cargo on top will fall onto the steel coils below.



Heavy crane counterweights and blocks stowed at the front edge of a high stow.

WIRE ROD IN COILS (WRIC)



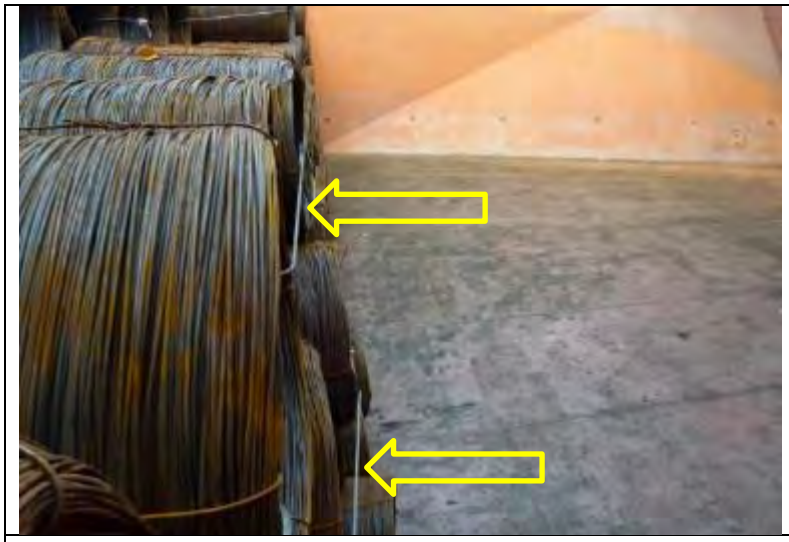
Lengths of structural steel stowed on top of coils. The WRICs stow collapsed and had to be off-loaded. Many of the coils were damaged.

Collapsed stow and deformed coils due to loading cargo above the coils.

Completing a stow in the aft part of the cargo hold. The forward-facing vertical wall will require to be lashed.

Lashing the vertical face. Note the lack of safety harnesses. No safety access to the vertical part of the stow.

WIRE ROD IN COILS (WRIC)



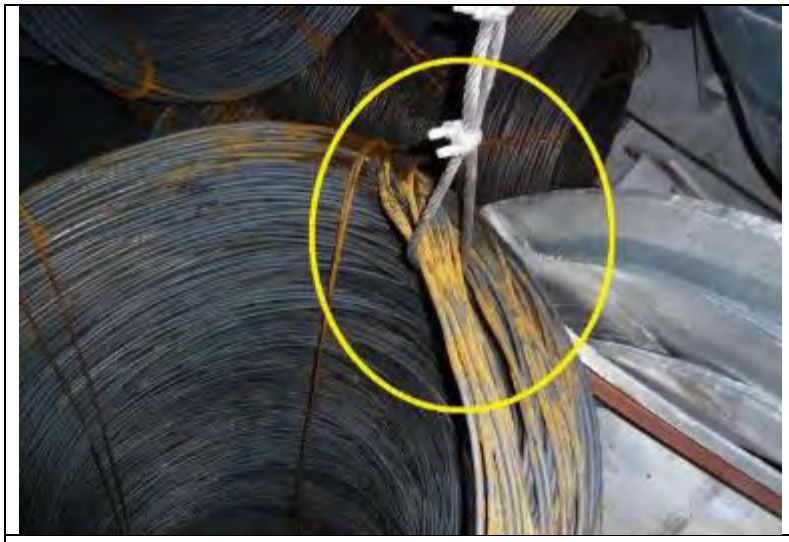
Wires are passed through the forward face of the coils. ✓

✓ The lashing wires are then passed through the coils towards the adjacent bulkhead.

The lashing wires are then secured to a designated lashing point inside the cargo compartments. ✓

✗ The wires shall not be secured to the bundling wires of WRICs further back in the stow.

WIRE ROD IN COILS (WRIC)



No part of a coil shall be used for securing any other cargo. The wire rod will be pulled out, which will damage the cargo and also result in loose and ineffective lashings.

Ports have experienced poorly stowed and secured WRICs. Here, the face of a vertical stow has partially collapsed. This is extremely dangerous for the stevedores when releasing the lashings.

This stow of coils has partially collapsed, with damaged and loose coils. Cargo in this condition is time-consuming and hazardous to off-load.

Another reasonable stow. However, the coils in the wing space are stowed longitudinally. There is safe access to the cargo direct from the Australian ladder.

WIRE ROD IN COILS (WRIC)

An athwartships stow in the under-coaming space. This type of stow makes off-loading by forklift truck easier and quicker. It shall be lashed individually.

Two stows of WRICs and rebars too close together. No lashing on the WRICs. Rebars off-loading in progress. Collapsing of the WRICs observed during the off-loading.

Combined stow of rebars and WRICs. Collapse of the WRICs in the under-coaming spaces. Difficult and unsafe access for off-loading.

Improper stow. The access to the lower tiers of the vertical face is hazardous.

WIRE ROD IN COILS (WRIC)

Six WRICs handled with two single leg baskets.

The coils will be off-loaded by the use of a single leg basket through WRICs. Four WRICs handled with two wire slings.

Two WRICs handled with two single leg baskets.

For example, Jurong Port has a multi-fork side-loader for transport from the quay to the storage area.

WIRE ROD IN COILS (WRIC)

SUMMARY CHECKLIST

- Plywood dunnage of at least 10mm thickness shall be used on the tank-top and wooden planks of approximately 15mm x 100mm cross-section for the bulkheads and, if required, between tiers.
- The height of the stow shall not exceed the manufacturer's recommendations for maximum number of tiers. If such recommendations are not provided, the same shall be requested. Without manufacturer's recommendation for the maximum number of stow, it would be considered reasonable for the tiers not to exceed 8 in height.
- For part hold loading, the cargo shall be loaded against the aft bulkhead.
- For the face of a part stow, as a minimum, the upper three tiers shall be secured to the aft bulkhead.
- Lashing of the top three tiers is not required for a full stow of WRICs. It is, however, recommended.
- When the under-coaming WRICs are stowed athwartships, then the top three tiers shall be lashed in a group. This stow is not to be lashed to the open hatch stow. The open hatch stow may not be lashed, if the stow is across the full length of the tank-top. It is a good practice, however, for the top three tiers to be lashed in a group.
- The WRICs shall not be overloaded with other cargoes.
- For partly stowed cargoes, front rows adjacent to the face are to be pre-slung. This will assist the off-loading in the event of collapsing of the stow in transit. (The number of tiers depends on the maximum height that a forklift truck can take them.)
- In the cargo compartments, where possible, safe passage shall be provided directly from the ladders to the top of the cargo stow. In bulk carriers, this access shall be provided directly from the Australian ladders. Safe access shall also be provided from the tank-top to the top of the cargo stow.

STEEL PLATE

GENERAL

Steel plate is thick, flat-rolled steel, produced from slab or ingot, and is supplied in various sizes and grades. Generally, the thickness can range from 5mm to 80mm. Sizes range from 2,000mm x 1,000mm up to 12,000mm x 3,000mm. Larger plates may be supplied to suit the end users' requirements. Loose steel plate is rarely bundled; however, smaller plates of similar dimensions may be bundled with steel strapping. Finished, cold rolled, plates will likely be packaged for protection.

Packaged steel plate with protective wrapping and timber supports attached with steel strapping.

Individual loose steel plates with no packaging or bundling.

STEEL PLATE

DUNNAGE

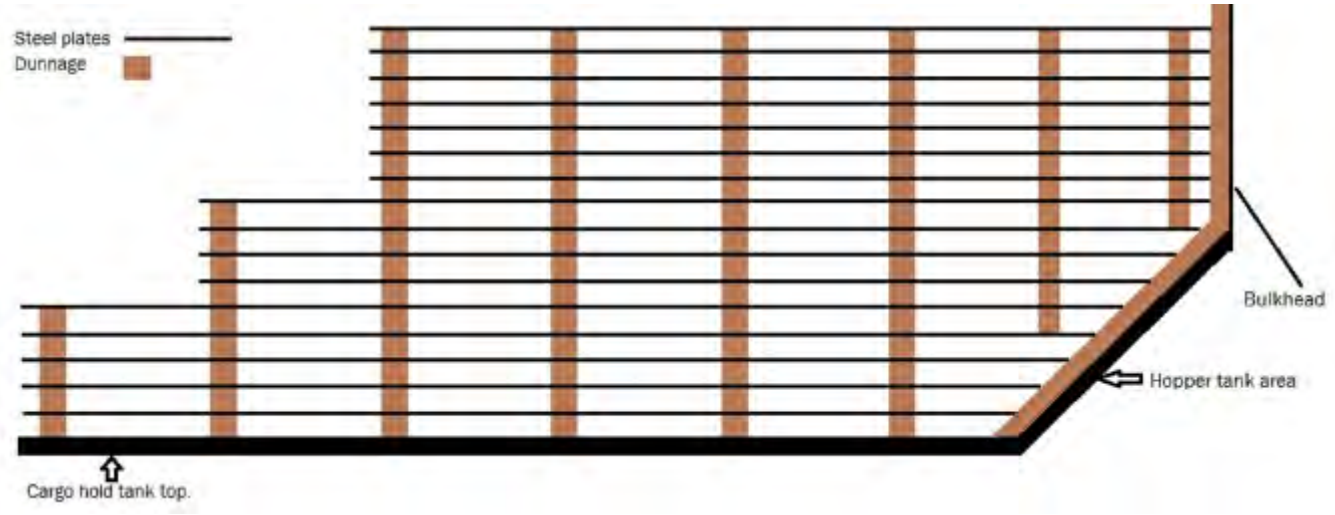
Steel plates have a tendency to shift if not correctly dunnaged as there is very little friction between steel plates laid directly atop each other. Steel plates are typically carried loose, although they may be strapped in bundles or packaged.

In accordance with industry good practice, good, dry, bark-free, hardwood dunnage shall be used throughout as softwood dunnage is too easily crushed or damaged.[6]

Dunnage shall be laid in rows on the tank-top in an athwartships direction under each row of plates. As a rule, the maximum distance between each row shall not exceed 3 metres under each plate; however, sufficient rows shall be laid to fully support the plates. One international steel manufacturer requires a minimum of 8 timbers to support a thin 12-metre long plate. Generally, 75mm x 75mm is the preferred cross-section to be utilised. Dunnage shall be placed between individual tiers, and chocks placed between plates/packages on every tier. Long plates are more susceptible to buckling/sagging if insufficient dunnage is used.

Similar dunnage shall be placed against the hopper, inner shell plating and bulkheads and the internal vertical frames in cargo ships. The higher or heavier the intended stow, the more dunnage shall be used on the tank-top and in the lower tiers.

Dunnage between tiers must be arranged such that the rows of dunnage are vertically aligned. This might not be possible in way of the hopper tanks but shall be adhered to wherever possible.



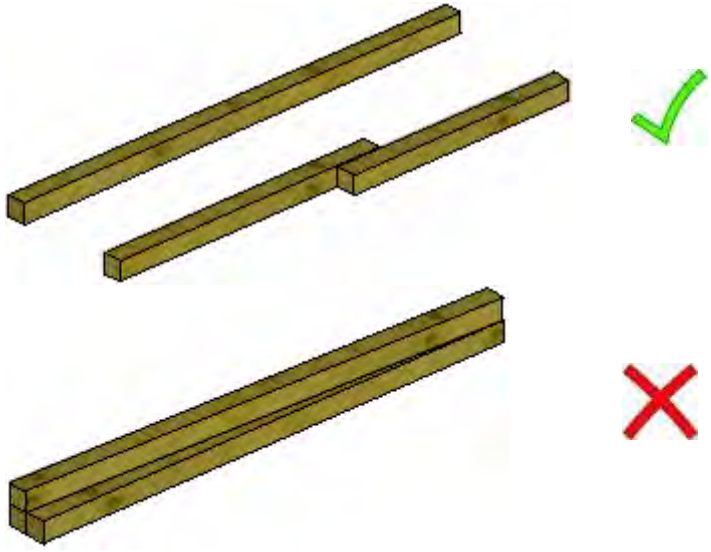
[6] Lloyd's Practical Shipping Guides – Steel: Carriage By Sea, 5th Edition 2009 (A. Sparks & F. Coppers).

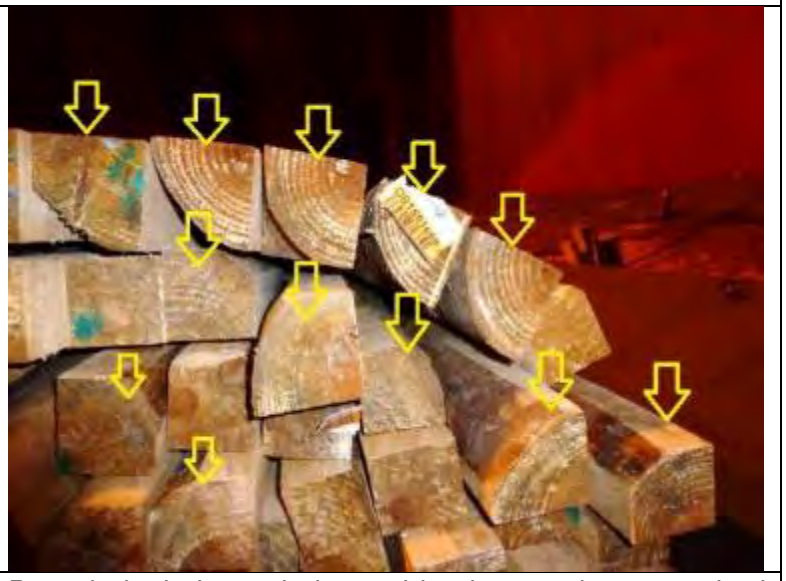
STEEL PLATE

Generally, a minimum of 75mm x 75mm of square cross-section is preferred.

Good, dry, hardwood dunnage shall be used for the loading of steel plates.

The length of the dunnage shall generally correspond to the steel plate's width. However, small-length dunnage may be used if properly aligned.





Square one-layer dunnage shall only be used. Double-stacked, rectangular dunnage or 1 on 2 stack dunnage arrangement shall not be used.

Rounded timber, timber with damaged or crushed corners, or non-square face dunnage, shall not be used.

STEEL PLATE

LASHINGS

All lashings shall conform with the requirements of the vessel's Cargo Securing Manual and the CSS Code.

When the cargo is stowed across the full width of the cargo hold, the steel plate is prevented from shifting by the friction resistance of the timber dunnage used in the stow and the additional timber dunnage used to block the top tier. Wire or chain lashings are used to secure the stow in a single block and prevent the initial movement of the steel plates. All lashings must be tight and well made. The Master shall be supplied with certificates for all the lashing equipment used.

An appropriate number of lashing wires or chains shall be laid in an athwartships direction on the tank-top in preparation for being passed back over the stow to secure the cargo in one block. There are no specific requirements for the minimum number of wires or chains to be used; however, a minimum of two per row would be considered reasonable. Intermediate lashings can be applied to longer plates to bundle the steel together to create a tighter block stow. Timber or manufactured plate edge protectors shall be used to protect the plate from damage and reduce the likelihood of the wires chafing.

The American Club, in their publication '*Transport Guidance for Steel Cargoes*', consider that, for ease of use, 16mm (6x12) wire rope with bulldog clips, turnbuckles and shackles would normally be used to lash steel cargoes.

Some shippers specify how much lashing to use, others rely on the skill and expertise of the lashing company. There may be specific requirements for lashing.

16mm Wire Rope supplied for lashing cargo

Bulldog grips and additional 'D' rings for cargo lashings

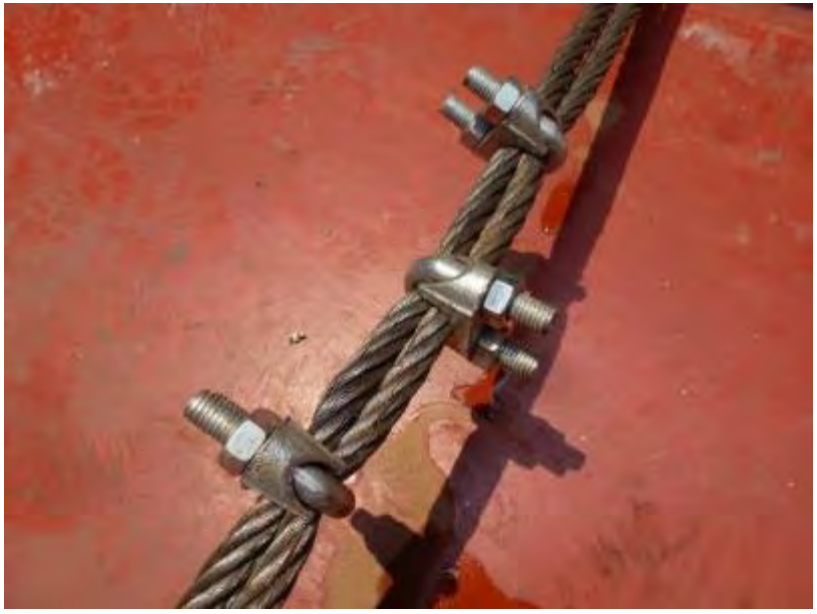
STEEL PLATE

For wires of up to 19mm diameter, a minimum of 3 bulldog grips shall be used at a spacing of approximately 6 times the diameter of the wire. The loose end shall be of length approximately 5 times the diameter of the wire. The grips saddles shall be on the live (load bearing) wire. The wires shall be tightened with rigging screws or turnbuckles. (UK P&I Club Best Practice: The Application of Bulldog Grips).

The publication Thomas' Stowage provides stricter guidelines with respect to the use of bulldog grips based on the size of the wires:

- 12-17mm diameter – 4 grips
- 18-24mm diameter – 5 grips
- 25+mm – 7 grips.

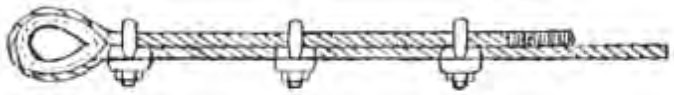
The bolts should be tightened sufficiently to compress the wire to $^2/_3$ of its nominal diameter. For lashing steel plates loaded throughout the full width of a cargo hold, 3 bulldog grips are considered to be sufficient for a 16mm wire. For a stow of steel plates not covering the full width of the hold, the guidelines of the Thomas' Stowage publication with respect to the use of bulldog grips shall be followed.



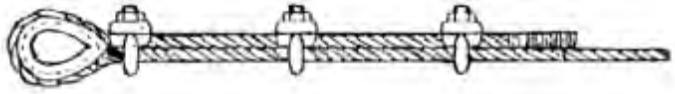
Incorrect way of using bulldog grips.

Correct way of using bulldog grips with grips on the live wire. Insufficient number of grips used.

STEEL PLATE



Right way of applying bulldog grips



Wrong way of applying bulldog grips

Diameter of wire ropes (mm)	**Bulldog grips** (Number)
Up to and including 19	3
Over 19: up to and including 32	4
Over 32: up to and including 38	5
Over 38: up to and including 44	6
Over 44: up to and including 56	7

Minimum number of bulldog grips on the basis of the wire size.

Source: UK P and I Club. Lashing and Securing of Deck Cargoes by John R. Knott.

STEEL PLATE

STOWAGE

All cargo shall be stowed in accordance with the IMO Code of Safe Practice for Cargo Stowage and Securing (CSS Code). It is usual to stow loose plates with the longest axis aligned in a fore-and-aft direction, although it is acceptable to stow plates athwartships in the middle of the stow. Bundled plate or packaged plate may be stowed athwartships for tighter and more efficient stow, as well as to suit the loading requirements. The plates/packages shall be loaded over the slope of the hoppers on bulk carriers and not stowed as a California block.

Steel is a heavy cargo, and the cargo hold tank-top loading limits must be considered when loading. The maximum height of the stow will depend on the allowable tank-top load limit determined by the shipyard and confirmed by the Classification Society when the vessel was built. It shall be remembered that this limit was calculated when the vessel was new; for older ships, with normal wear and tear on the tank-top plating and associated underdeck stiffening, it is prudent to allow a safety margin.

The stow shall be kept level throughout, with timber dunnage used to fill any gaps in the stow.

Any timber structures built to support the stow must be free-standing and sufficiently robust to survive the rigours of the voyage. If the structures collapse, the integrity of the stow will be compromised and plates/packages will inevitably move. This will likely cause serious damage to the vessel and/or its stability and would inevitably lead to serious issues for the discharge operations.

All gaps in the top tier of plates shall be chocked with timber dunnage to provide a secure, tight and level stow across the full width of the cargo hold.

A level top stow of loose steel plates. Timber dunnage is used to secure the top plates, though this is not yet completed.

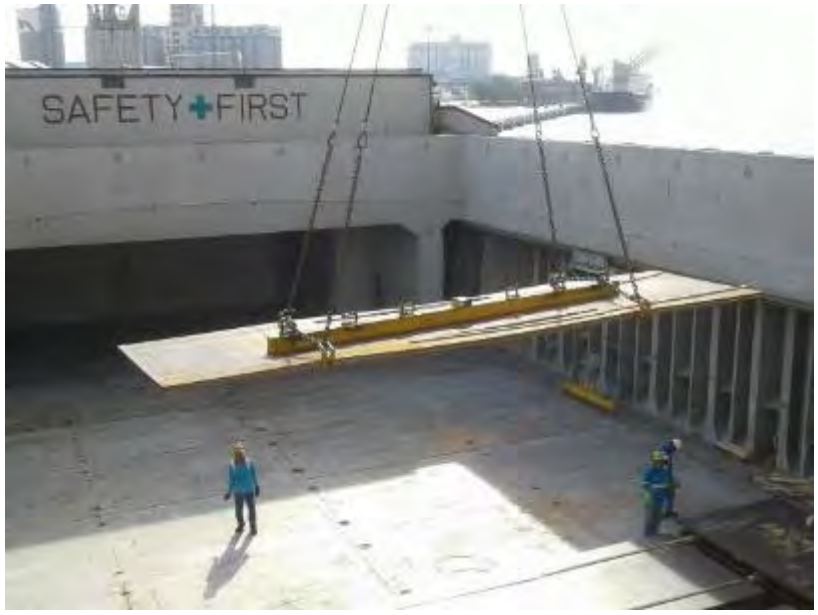
STEEL PLATE

Ports use ‘C’ clamps to off-load steel plates, four clamps per lift. The jaw opening of the clamps is 125mm. The maximum permitted combined plate thickness (or a bundle), which can be lifted with these clamps, is 110mm. No single tier of loose plates shall exceed this height.

The typical weight calculation for a steel plate with dimensions 9.145m x 2.438mm x 0.011m is approximately 1.86 tonnes (given a stowage factor of 7.6 tonnes per m^3).

The SWL of each clamp is 5 tonnes; to allow for a sufficient safety margin, the maximum weight for each lift is 18 tonnes. For standard steel plates, with dimensions of 9.145m x 2.438m x 0.011m, and a density of 7.6 tonnes per m^3, the maximum number of plates to be lifted at one time would be 7.

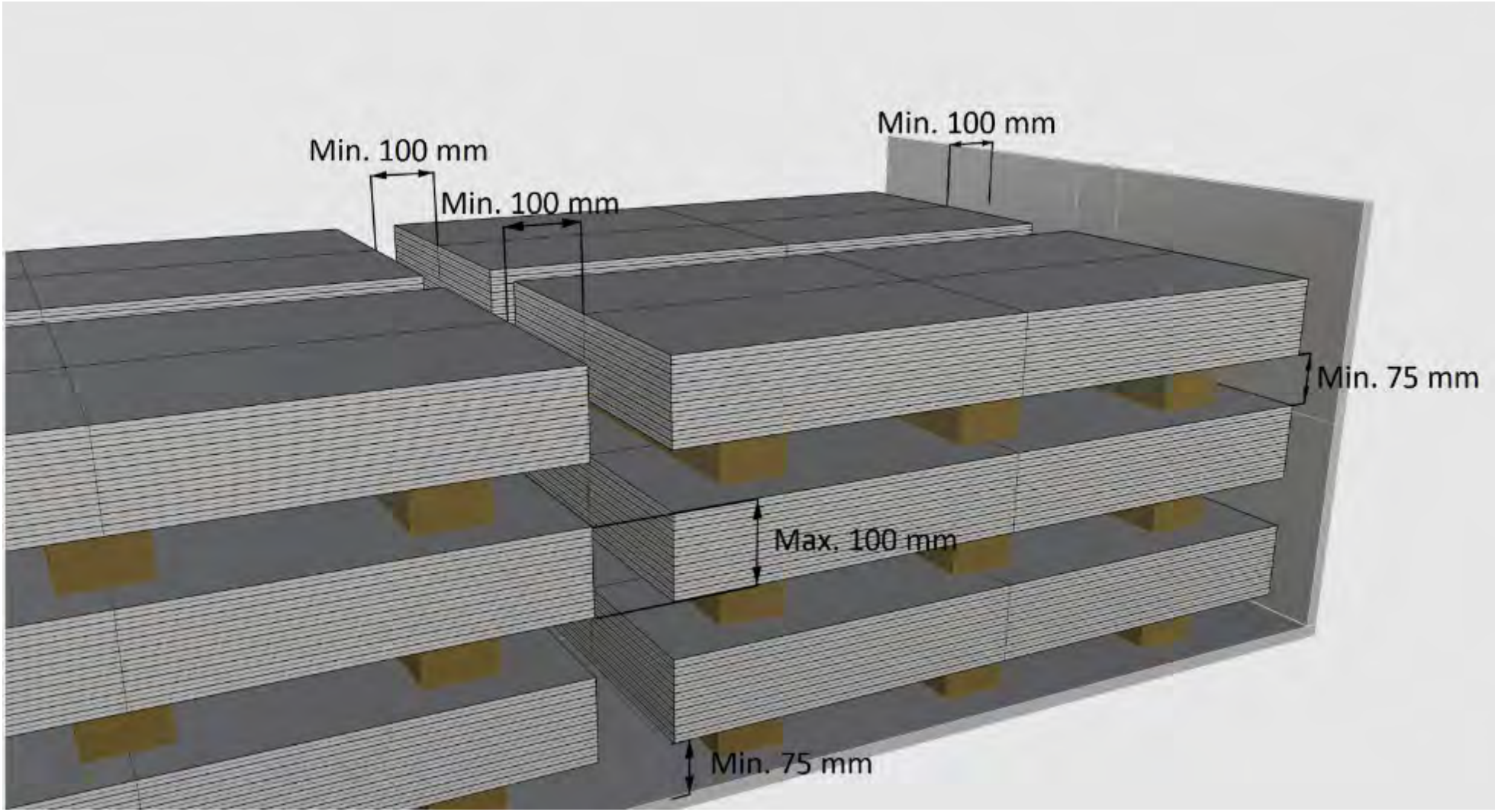
‘C’ hooks used for off-loading.



C-hooks and a spreader used for the off-loading of steel plates.

Close-up of *‘C’* hooks.

STEEL PLATE



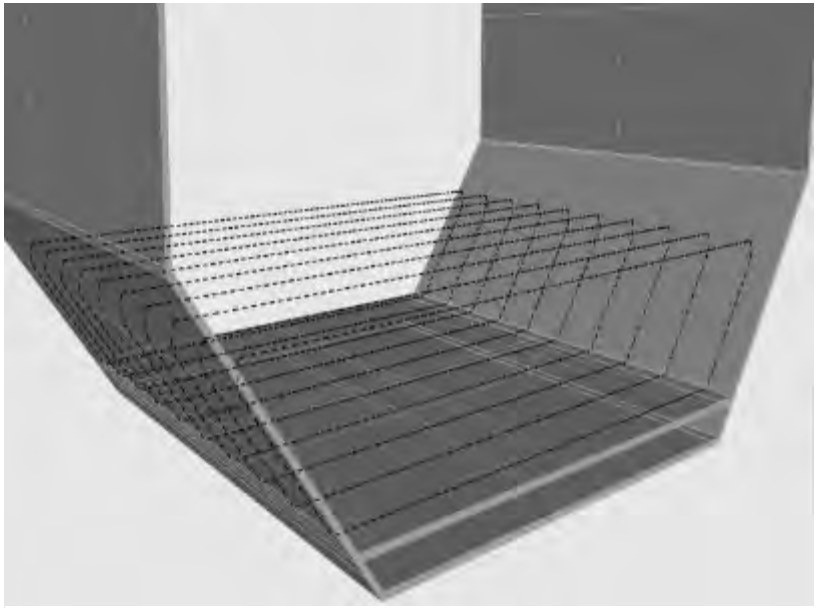
To allow the stevedores to correctly position the clamps, a minimum distance of 100mm clearance must be left around the steel plates and at least 75mm between tiers. The thickness of the bundle or the number of plates stowed in one tier shall not exceed 110mm.
Note: For illustration purpose, the vertical dunnage between the bundles is not shown on the schematics.

STEEL PLATE

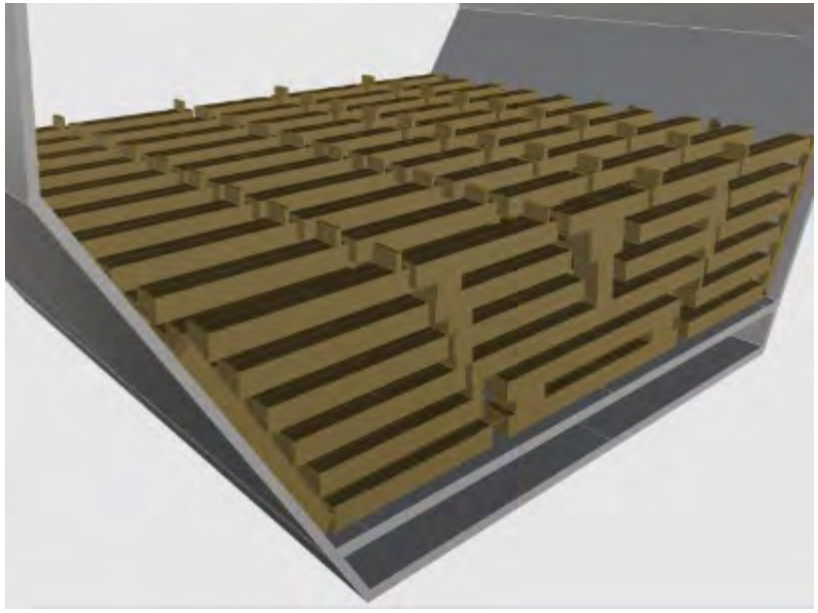
SCHEMATICS FOR CORRECT LASHING AND DUNNAGING

All schematics are indicative.

Schematics of the dunnage and lashing to be used for a stow of steel plates. The dunnage shall be hardwood and of minimum size 75mm x 75mm. A minimum of two wires positioned on the tank-top and passed athwartships per 6-metre length or a minimum of three per 9-metre length of steel plates would be considered reasonable.

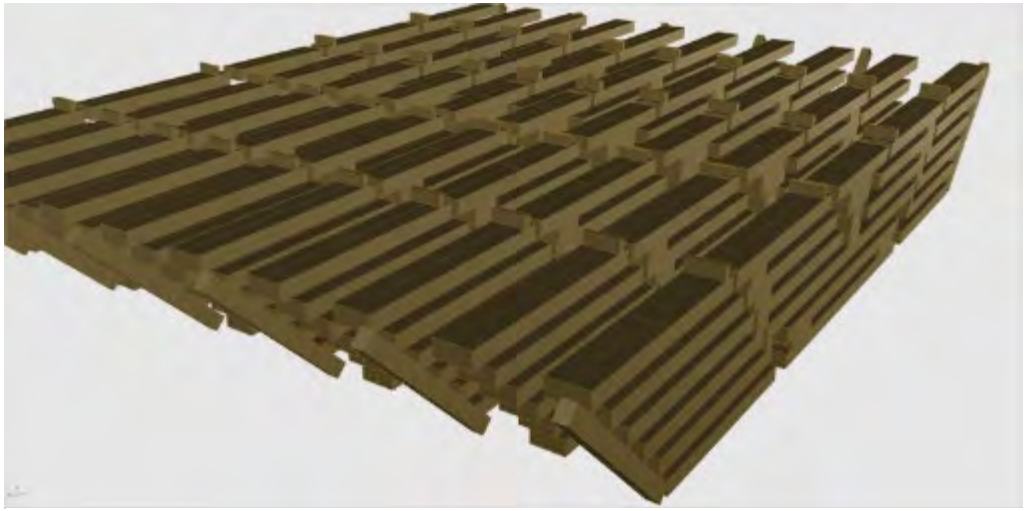


Lashing of the steel plates stow starting from the tank-top. The wires spacing shall be approximately 3 metres.



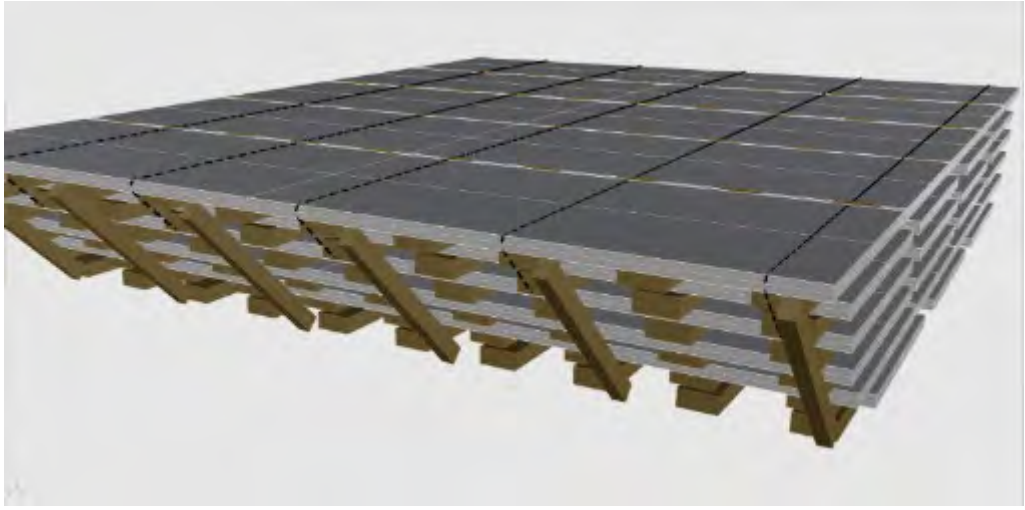
Hardwood dunnage of the steel plates stow. The spacing of the dunnage shall not exceed 3 metres.

STEEL PLATE

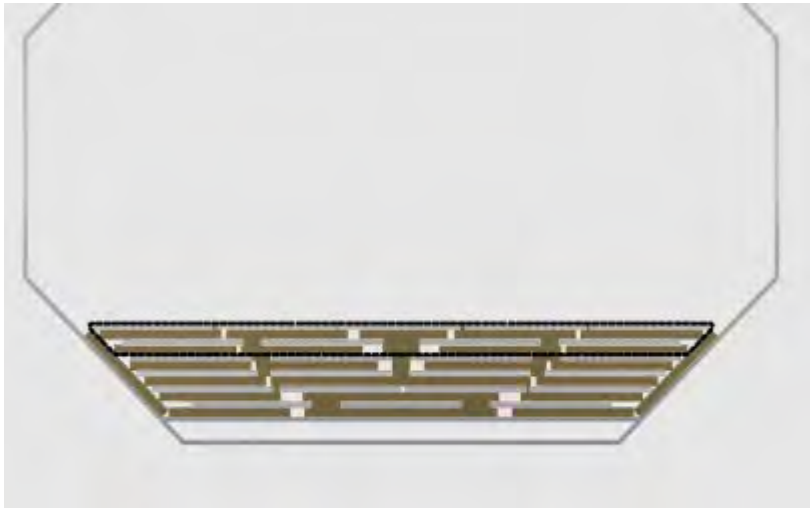


The dunnage shall be spaced approximately 3 metres.

Steel plate stow with dunnage and top tier lashing.



Steel plate stow with dunnage and top two tiers lashing.



Steel plate stow with dunnage and top two tiers lashing.

STEEL PLATE

UNDER-COAMING STOWAGE

All cargoes are off-loaded by vertical lift only. Ports do not normally use the lifting gear to drag cargo from the under-coaming spaces to the open hatch square, as it overloads the lifting gear and equipment, which can lead to catastrophic failure. To facilitate the off-loading of such cargo, forklift trucks are utilised.

This requires that the steel plate in the center of the cargo hold be level and the timber dunnage under the plate sufficiently strong to withstand the movement of the forklift truck as it pulls the cargo clear from the wing space to be off-loaded.

Steel plate being lifted, by a forklift truck, from the wing space of a bulk carrier.

Incorrect handling steel plates under the coaming. The lift is not plumb, and the cargo will sway dangerously towards the center of the hold.

STEEL PLATE

A bulk carrier cargo hold in a clean condition ready for loading cargo.

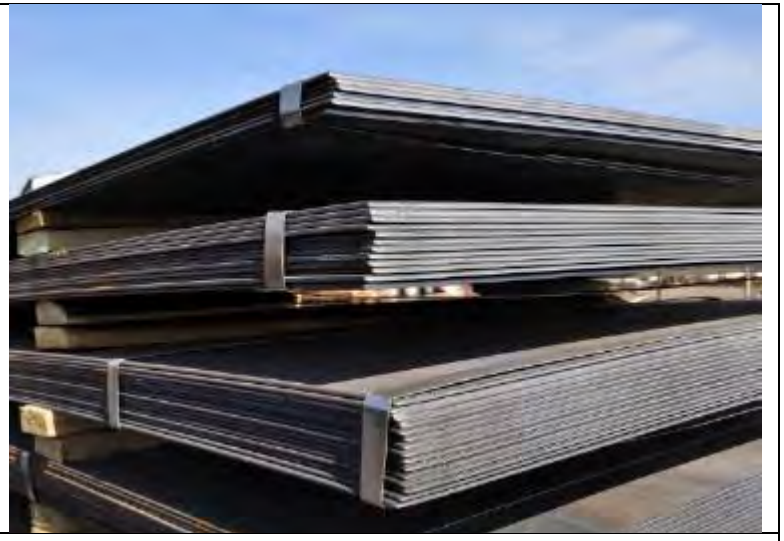
A cargo ship with box-shaped cargo holds and pontoon 'tween deck ready for loading.

Poorly prepared cargo hold on a bulk carrier. Residue from some bulk cargoes can react with, and damage, the steel cargo.

Unprepared cargo hold on a bulk carrier. Residue from some cargoes can react with, and damage, the steel cargo.

STEEL PLATE

Delivering of the cargo at the jetty prior to the loading.



Unbundled, long steel plates.

Bundled steel plates, ready for shipment. Only bundles of 110mm height are accepted for handling at ports.

Delivering of the cargo at the jetty prior to the loading.

Unbundled, long steel plates loaded with a spreader.

It is recommended to use suitable edge protection when wire slings are used for handling the cargo.

STEEL PLATE

Bundled, palletised, pre-fabricated steel plates.

Loading of steel plates with ‘C’ clamps.

General cargo vessel with box-type cargo compartments. Lower hold and tween deck. Athwartships loading. Under-coaming loading.

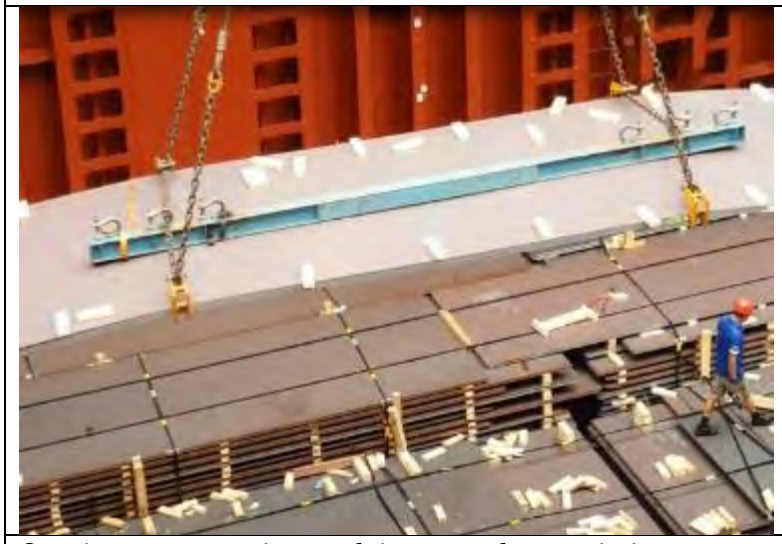
Holds must be swept clean and dry prior to the loading of steel plates.

Dry bulk carrier with hopper-type cargo holds. Dunnage shall be used on the tank-top, side hopper tanks and bulkheads.

STEEL PLATE

Bundled steel plates ready for loading. Choke hitch chain sling in use.

Bundled steel plates. Broken steel straps. Incorrect choke hitch application.

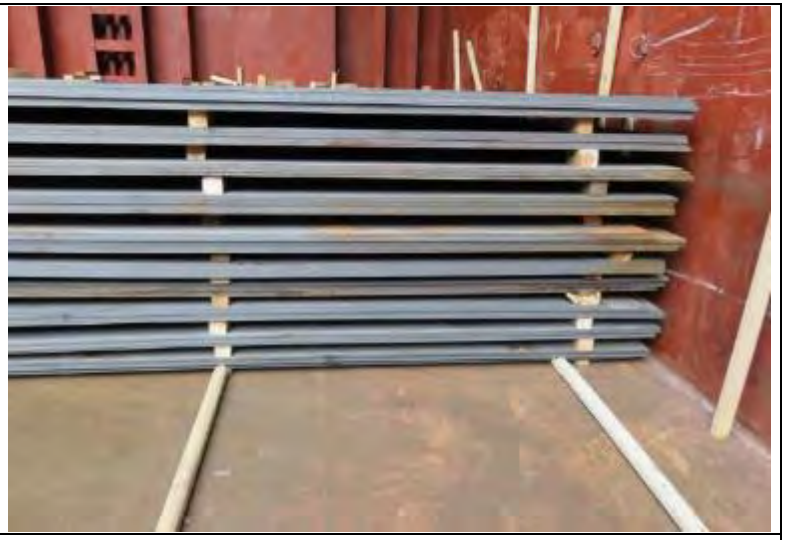


Good stowage and use of dunnage for steel plates.

Good application of dunnage for steel plates. It is acceptable to use short hardwood dunnage pieces instead of long bars.

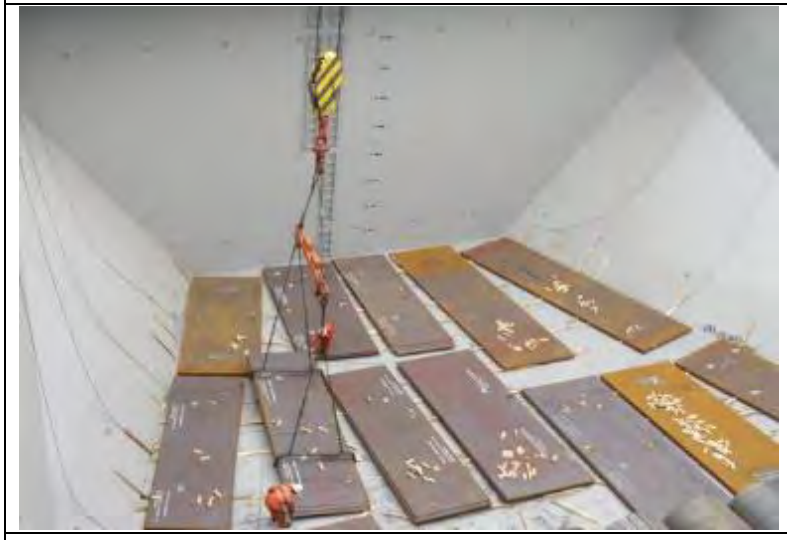
STEEL PLATE

The stow lashing shall be prepared prior to the first tier being loaded.



Lashing wires for securing of the final stow must be prepared on the tank-top prior to the loading of the plates.

The horizontal dunnage on the tank -top and between the tiers must be vertically aligned.



The stow block may be interlocked with alternate longitudinally and athwartships-oriented steel plates.

Plates shall be loaded longitudinally. The illustration shows the aft most hopper-type cargo compartment of a bulk carrier.

The longitudinally oriented plates may be locked in with athwartships-oriented plates for compactness of the stow.

STEEL PLATE

Dunnage must be placed between the stow and the bulkheads.

Incorrect use of dunnage.

The dunnage between the tiers shall generally be of whole piece square cross-section dunnage, although it is not unusual to use well-aligned small pieces of dunnage.

Chocking of the last two tiers shall not be done this way. The dunnage in the photo is not sufficient and may slip.

STEEL PLATE

Proper dunnage structure shall be formed between the stow and the bulkheads. Vertical wood must exist on the side of the bulkheads and stow.

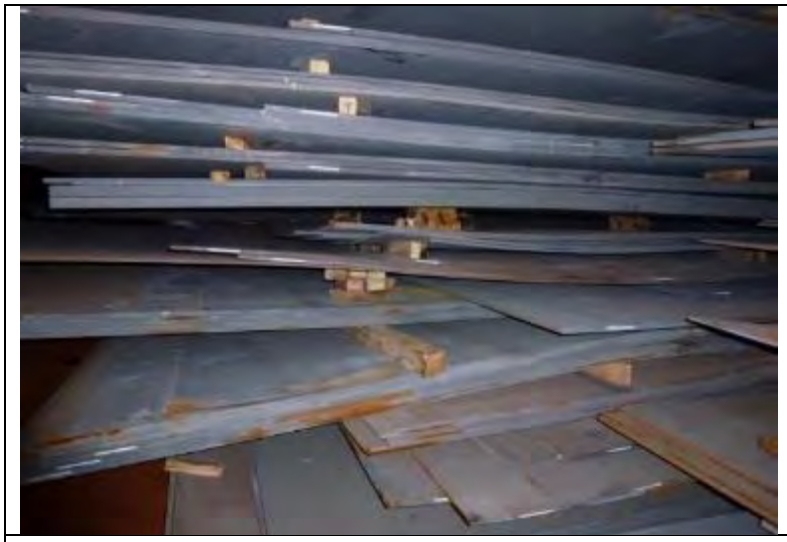
Incorrect use and securing of dunnage. The wood may easily slip from the bulkhead and fall from its place during voyage.

Incorrect use of dunnage and lashing. There is no vertical dunnage on the side of the stow to support the horizontal wooden beams. No protector on the wire.

Good use of dunnage between the stow and the hopper-type bulkhead.

Poor use of dunnage between the stow and the hopper-type bulkhead. The dunnage contacting the plate edge shall be flat.

STEEL PLATE



Improper stow, alignment and use of dunnage.

Vertical alignment of the dunnage is important. Any loose ends of tiers shall be properly supported underneath.

Missing dunnage at the bulkhead. Incorrect use of dunnage to support tiers.

Correct use of dunnage. The dunnage is additionally secured horizontally. Incorrect use of bulldog grips on the left wire.

Dunnage must be used for securing the existing gaps on the upper tier of plates. Strong solid horizontal compact arrangement shall be made.

Incorrect use of dunnage. The pieces of wood are prone to collapse.

STEEL PLATE

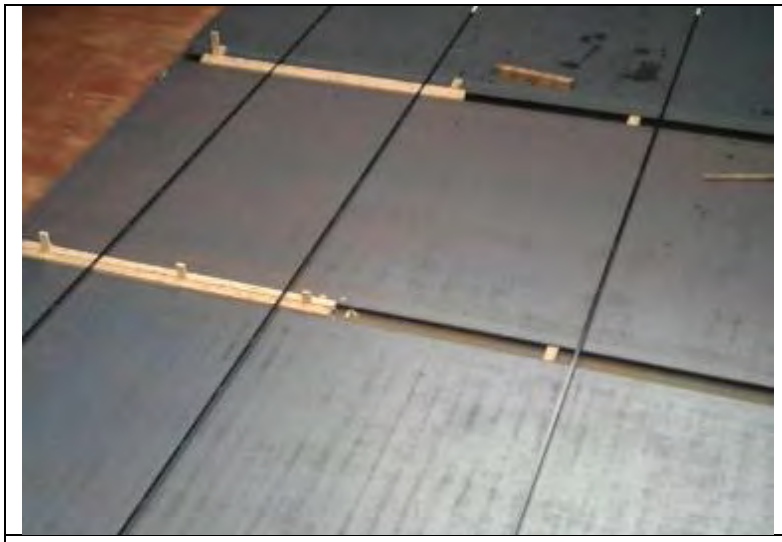
The stow must be secured. Generally, wire rope lashing is used.

The wire clips are insufficient and are also incorrectly placed. The grips shall be on the live wire and a minimum of 3.

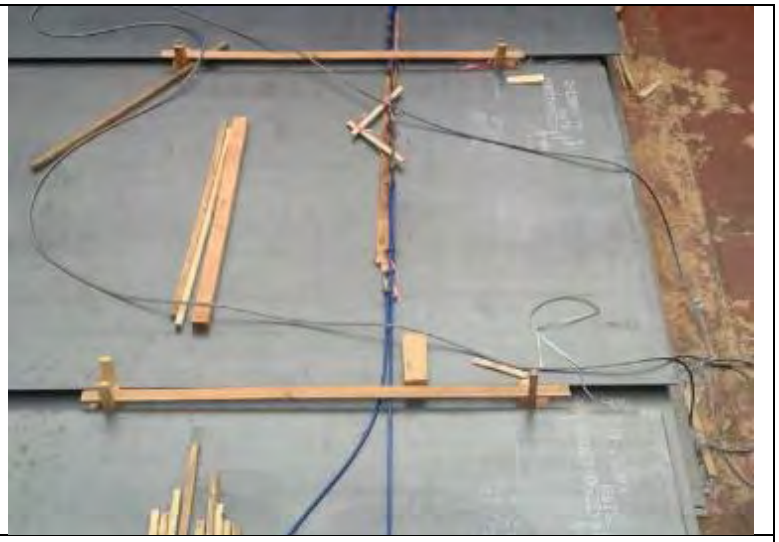
Stow of steel plates loaded athwartships. Stow prior to the final lashing.

Stow of steel plates in longitudinal and athwartships direction. The upper tiers only are lashed with steel bands.

STEEL PLATE



Condition of steel plates on arrival at discharging port.



Good stow, lashing and use of dunnage.

Good stow; removal of the lashing.

Off-loading of unbundled, unpacked steel plates. Use of 'C' hooks and a spreader.

Off-loading of unbundled, unpacked steel plates. Use of 'C' hooks and a spreader.

STEEL PLATE

Use of a forklift truck for the discharging of steel plates in hopper-type cargo hold. Handling of steel plates underneath the coamings with missing tier dunnage.

The fork is used to separate the plates and to allow for space to be created for placing dunnage before the final lift with the truck is done.

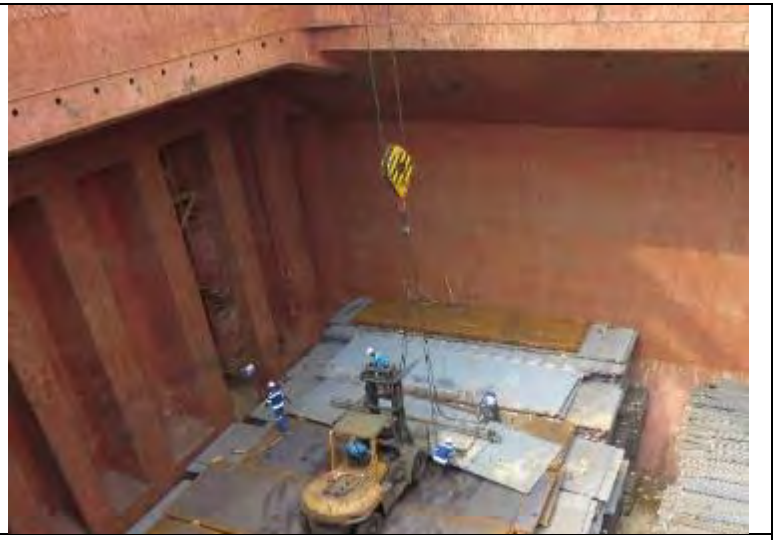
The steel plate is to be lifted to allow for assisting dunnage to be placed under the plate.

The steel plate is pulled out of the under-coaming space for a direct access with the crane.

Discharging of bundled steel plates. Use of 'C' hooks and a spreader.

STEEL PLATE

Use of a forklift truck for the discharging of steel plates in box-type cargo hold.



Use of a forklift truck for the discharging of steel plates in hopper-type cargo hold. Handling of steel plates underneath the coamings.

Discharging of unbundled, unpacked steel plates. Use of 'C' hooks and a spreader.

For example, Jurong Port is equipped with side loaders with an SWL of 22 tonnes each.

STEEL PLATE

SUMMARY CHECKLIST

- Tank-top load limits not to be exceeded. Consideration to be given to the hopper areas, where the load limits may be smaller.
- Tank-top to be prepared with appropriate hardwood dunnage to prevent the steel plate bending or buckling. The spacing of the dunnage shall not exceed 3 metres. Shorter pieces may also be used.
- Dunnage to be of hardwood with minimum cross-section 75mm x 75mm.
- Dunnage between tiers to be laid in a vertical line to prevent waviness in the steel plate.
- Lashing wires at a spacing not more than 3 metres to be positioned on the tank-top in preparation for the final lashing of the stow.
- The full stow may be lashed in one block. Alternatively, the last two tiers or the last tier of steel plates shall be lashed.
- Separate tiers or bundle heights (between horizontally placed dunnage beams) shall not exceed 110mm.
- A minimum clear distance of 100mm is required between edges of the steel plates and adjacent cargo or bulkheads. This distance shall be properly dunnaged.
- All tiers to be stowed level.
- In the cargo compartments, where possible, safe passage shall be provided directly from the ladders to the top of the cargo stow. In bulk carriers, this access shall be provided directly from the Australian ladders. Safe access shall also be provided from the tank-top to the top of the cargo stow.

STEEL PIPES

GENERAL

Pipes are long circular hollow section tubes used for transfer of liquids and gases. They are typically shipped in all manner of sizes and configurations from bundles (commonly hexagonal in shape) of finished steel small-bore pipes, to large rubber-clad pipes destined for the offshore sectors. The ends of the pipes may be threaded, bevelled, flanged or swaged, all of which are prone to damage. Pipes are frequently shipped with protective end covers, which are sometimes supplied loose and, if so, shall be fitted prior to loading.

BUNDLING

Small to medium diameter pipes may be bundled. The bundle takes usually a hexagonal shape and can also be packaged, depending on the finishing of the pipes. Only pipes of the same diameter shall be bundled together.

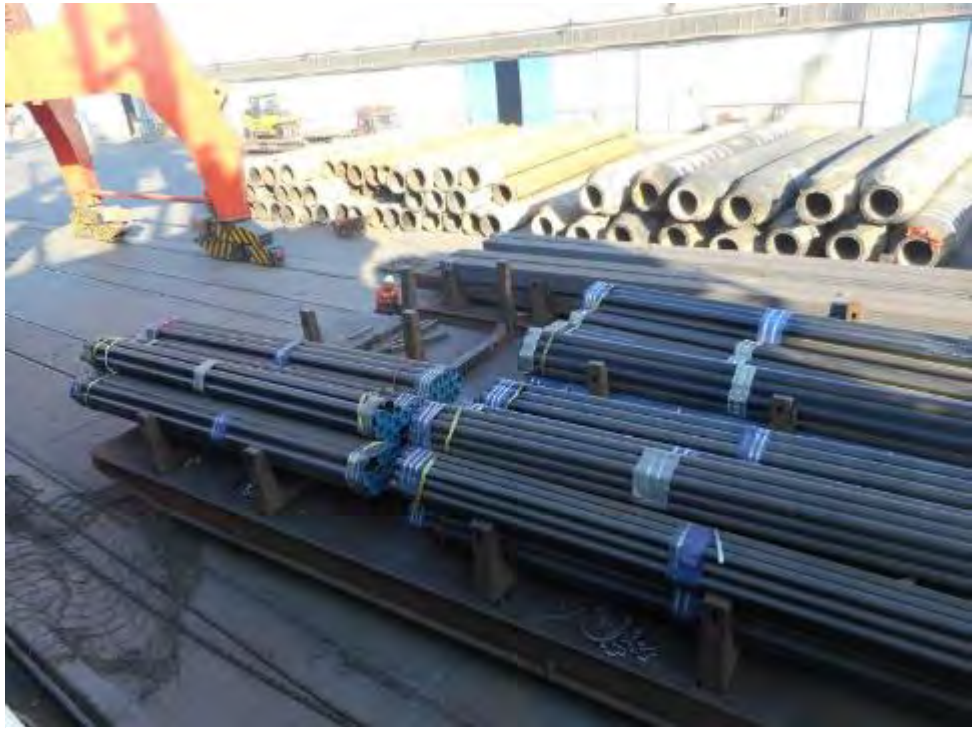
The bundling of small diameter pipes is usually made with steel strapping. The strapping shall be tightly applied in order to avoid loose bundles with failed hexagonal shape.

The bundling may also take a square shape, where dunnage is used between the tiers within the bundle.

Bundles shall not be used for handling, tip-lifting or overhead transfer.

Medium size pipes may not arrive in a bundled form and may be loaded as single pipes.

Large diameter pipes usually arrive in an unbundled form and are loaded as single units.



An assortment of pipes waiting to be loaded. Flanged, rubber-coated pipes in the background and bundles of finished steel pipes with pipe-end caps on the trailer.

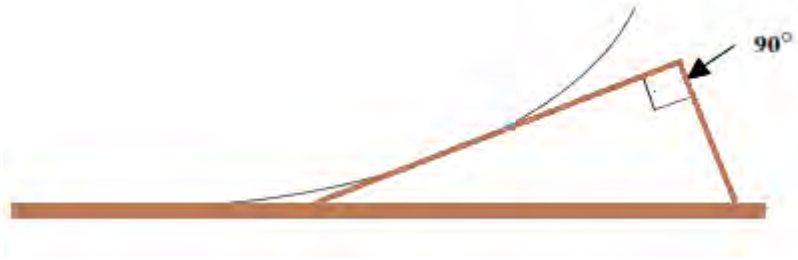
STEEL PIPES

DUNNAGE

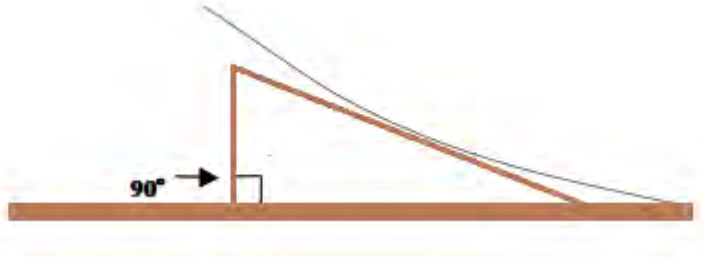
In the hold, bark-free hardwood dunnage shall be laid on the tank-top in preparation for loading. The dunnage shall be of 25mm x 150mm [1" x 6"] cross-section and laid athwartships, in rows of up to a maximum of 3 metres apart. The first and last rows shall be no more than one metre from the pipes' ends. The dunnage shall extend on the hoppers and side bulkheads. Where the pipes have flanges, bell ends, swaged ends, bevelled ends etc., the dunnage laid at the tank-top shall be of square cross-section, to protect the pipes' ends from damage as a result of contact with the tank-top.

The exact arrangement for dunnage will depend on the type and weight of the pipes and the number of tiers in the stack. For if the stow consists of 8 tiers and more, then the dunnage at the tank-top and between the first 3 tiers shall be of hardwood. Softwood dunnage boards shall also be laid against the vessel's side structures to prevent steel-on-steel contact and to prevent movement. Dunnage between tiers is a requirement for bundled pipes. For single loose pipes, dunnage is not always required. However, the top tier requires dunnage between the pipes and between the stow and the side bulkheads to prevent horizontal shift.

The first tier of large diameter pipes will additionally require wooden wedges on both sides of each pipe to be nailed on the dunnage planks. Such wedges shall be positioned at both ends and in the middle of the pipe. No dunnage will be required between the subsequent tiers, as the pipes are stowed in the cantlines of the lower tiers.



Correctly positioned wooden wedge.



Incorrectly positioned wooden wedge.

Dunnage may be required between the tiers of single small to medium diameter pipes, where these are loaded in the under-coaming spaces. In this case, the size shall be of 75mm x 75mm square cross-section. If the pipes are bundled in a hexagonal shape, and where dunnage is to be used, consideration shall be given for the increase of the broken stowage and the volumetric capacity of the cargo compartment.

Bundles in rectangular or square cross-section form, usually arrive with dunnage within the bundle, allowing for proper stowage. Where there is no such dunnage, the use of athwartships dunnage between the tiers is to be used.

STEEL PIPES

When stowed on the hatch covers, softwood dunnage boards shall ideally be positioned over the hatch covers' transverse stiffening members. Each pipe shall be hard up against its neighbour and, for loose pipes, wedges inserted on either side of each pipe in the lowest tier. The wedges shall be nailed to the underlying dunnage boards, to prevent the pipes from rolling.

Where the holds taper at the forward/aft ends, additional steel or timber structures might be required to support the pipes at the wider end to maximise the use of the available cargo space. Due consideration shall be made to the strength of these structures and that of the hopper tanks.

Any such structures constructed of steel shall be lined with a suitable material – timber, rubber etc.

Suitable protective material shall be placed on the pipes in way of lashings to protect the surfaces; this could be pieces of timber dunnage, rubber matting, or pipe edge protectors.

Solid dunnage structure is usually required to be built between the ship's sides and the pipes' stowage, where large diameter pipes are loaded.

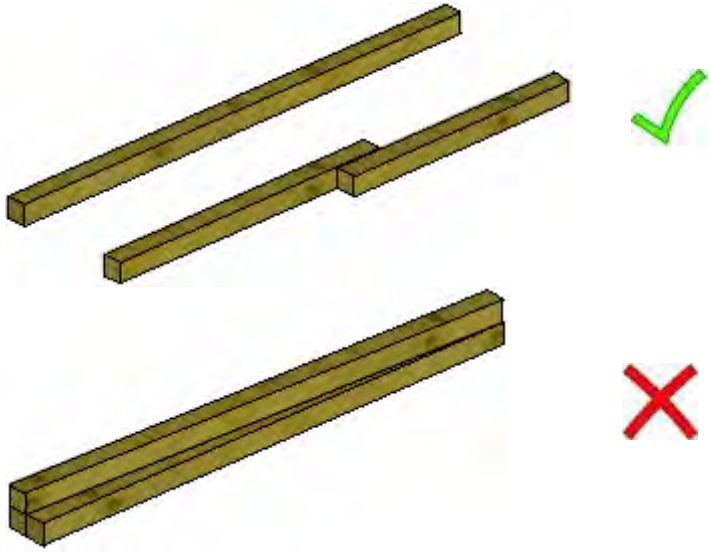
Dunnage being laid on the tank-top in preparation for the loading of loose pipe.

STEEL PIPES

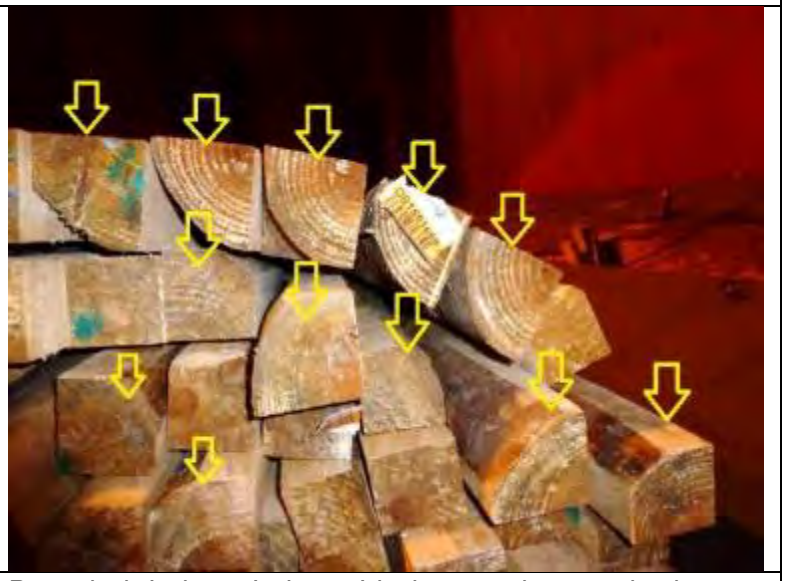
Generally, a minimum of 75mm x 75mm of cross-section dunnage shall be used between tiers. At the tank-top, 150mm x 25mm hardwood dunnage shall be used.

Good, dry, dunnage shall be used for the loading of steel pipes up to the third tier of the stow.

The dunnage is placed as continuous rows spaced at approximately 3 metres.



Square one-layer dunnage shall only be used. Double-stacked, rectangular dunnage or 1 on 2 stack dunnage arrangement shall not be used.



Rounded timber, timber with damaged or crushed corners, or non-square face dunnage shall not be used.

STEEL PIPES

LASHINGS

All lashings shall conform with the requirements of the vessel's Cargo Securing Manual and the CSS Code.

When the cargo is stowed across the full width of the cargo hold, the pipes are prevented from shifting by the friction resistance of the timber dunnage used in the stow and the additional timber dunnage against the bulkheads. Metal straps or nylon web lashings are used to secure the stow in a single block and prevent the initial movement of the pipes. All lashings shall be tight and well made. The Master shall be supplied with certificates for all the lashing equipment used.

An appropriate number of lashings shall be laid in an athwartships direction on the tank-top in preparation for being passed back over the stow to secure the cargo in one block. There are no specific requirements for the minimum number of metal straps to be used; however, a minimum of three per row would be considered reasonable. Timber or manufactured pipe edge protectors shall be used to protect the pipes from damage and reduce the likelihood of the chafing.

Metal strapping used for securing of pipes. The tightening shall be made with the use of pneumatic tools.

Nylon web strapping used to lash a stow of medium size pipes. The lashing is made only on the top tier of pipes in a box-shape cargo compartment.

STEEL PIPES

For non-coated pipes, wires may be used for lashing. The American Club, in their publication "*Transport Guidance for Steel Cargoes*", consider that, for ease of use, 16mm (6x12) wire rope with bulldog grips, turnbuckles and shackles would normally be used to lash steel cargoes:

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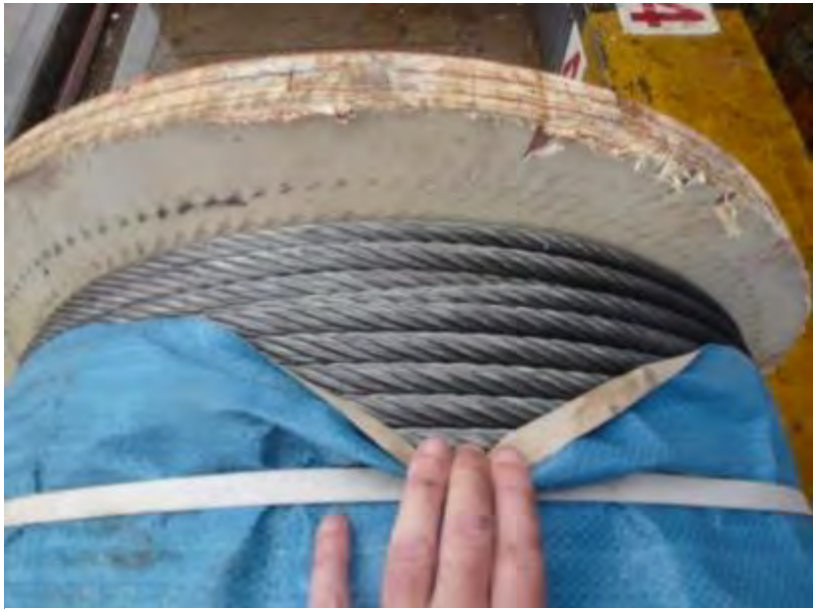


16mm wire rope supplied for lashing cargo.

Bulldog grips and additional 'D' rings for cargo lashings.

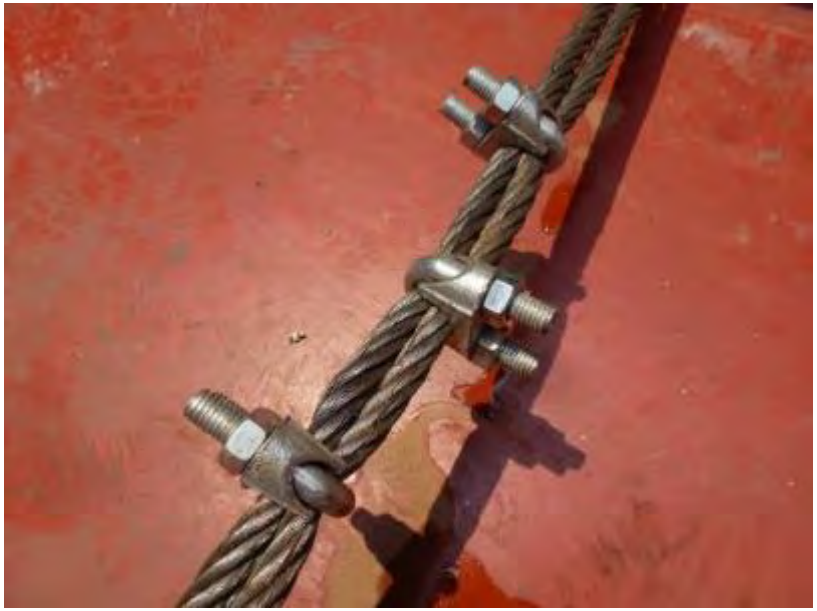
STEEL PIPES

For wires of up to 19mm diameter, a minimum of 3 bulldog grips shall be used at a spacing of approximately 6 times the diameter of the wire. The loose end shall be of length approximately 5 times the diameter of the wire. The grip saddles shall be on the live (load bearing) wire. The wires shall be properly tightened with turnbuckles or rigging screws. (UK P&I Club Best Practice: The Application of Bulldog Grips).

The publication Thomas' Stowage provides stricter guidelines with respect to the use of bulldog grips based on the size of the wires:

- 12-17mm diameter – 4 grips
- 18-24mm diameter – 5 grips
- 25+mm – 7 grips.

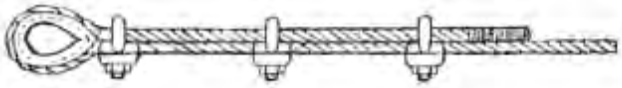
The bolts should be tightened sufficiently to compress the wire to $^{2}/_{3}$ of its nominal diameter. For lashing pipes loaded throughout the full width of a cargo hold, 3 bulldog grips are sufficient for a 16mm wire. For a stow of pipes not covering the full width of the hold, the guidelines of the Thomas' Stowage publication with respect to the use of bulldog grips shall be followed.



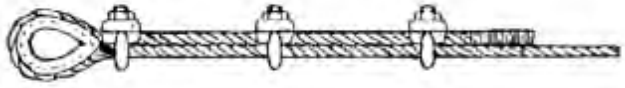
Incorrect way of using bulldog grips.

Incorrect way of connecting two wires and using bulldog grips. Insufficient number of grips used.

STEEL PIPES



Right way of applying bulldog grips



Wrong way of applying bulldog grips

Diameter of wire ropes (mm)	**Bulldog grips** (Number)
Up to and including 19	3
Over 19: up to and including 32	4
Over 32: up to and including 38	5
Over 38: up to and including 44	6
Over 44: up to and including 56	7

Minimum number of bulldog grips based on the wire size.

Source: UK P and I Club. Lashing and Securing of Deck Cargoes by John R. Knott.

STEEL PIPES

STOWAGE

All cargo shall be stowed in accordance with the IMO Code of Safe Practice for Cargo Stowage and Securing (CSS Code).

Pipes may be stowed in the hold or on deck. It is usual to stow steel pipes aligned in a fore-and-aft direction, although it is acceptable to stow pipes athwartships in the middle of the stow or across the ends of box-shaped holds, provided that the pipes are of a similar length to the width of the hold. Steel or timber constructions may be required to fit the slope of the hoppers on bulk carriers, particularly in the forward and aft cargo holds where the tank-tops taper – it is not acceptable to fan-out the stowage of pipes to fit with the shape of the hold.

A stowage of pipes shall ideally be of a single size and type of pipe. If different-sized pipes, or pipes with different coatings or end finishes, are stowed together, the block is unlikely to be uniform, and damage to the pipes may occur. Should different-sized pipes be stowed in one block, the larger diameter/heavier pipes shall be at the bottom of the stow.

When pipes with differing characteristics, such as coatings, end fittings, etc., are to be loaded, the shipper shall be consulted to confirm that the intended arrangement is satisfactory.

When pipes have flanges, bell ends, swaged ends, bevelled ends etc., they shall be stowed such that the flange is at opposite ends of the stow on alternate rows. This may involve stepping the face of the stow to achieve, but it will ensure a uniform block stow.

For the heavier and/or larger diameters of pipe, the shipper shall be consulted with respect to the maximum number of tiers that may be stowed.

Each pipe shall be stowed such that it is hard up against its neighbour, positioned in the cantlines of the row below.

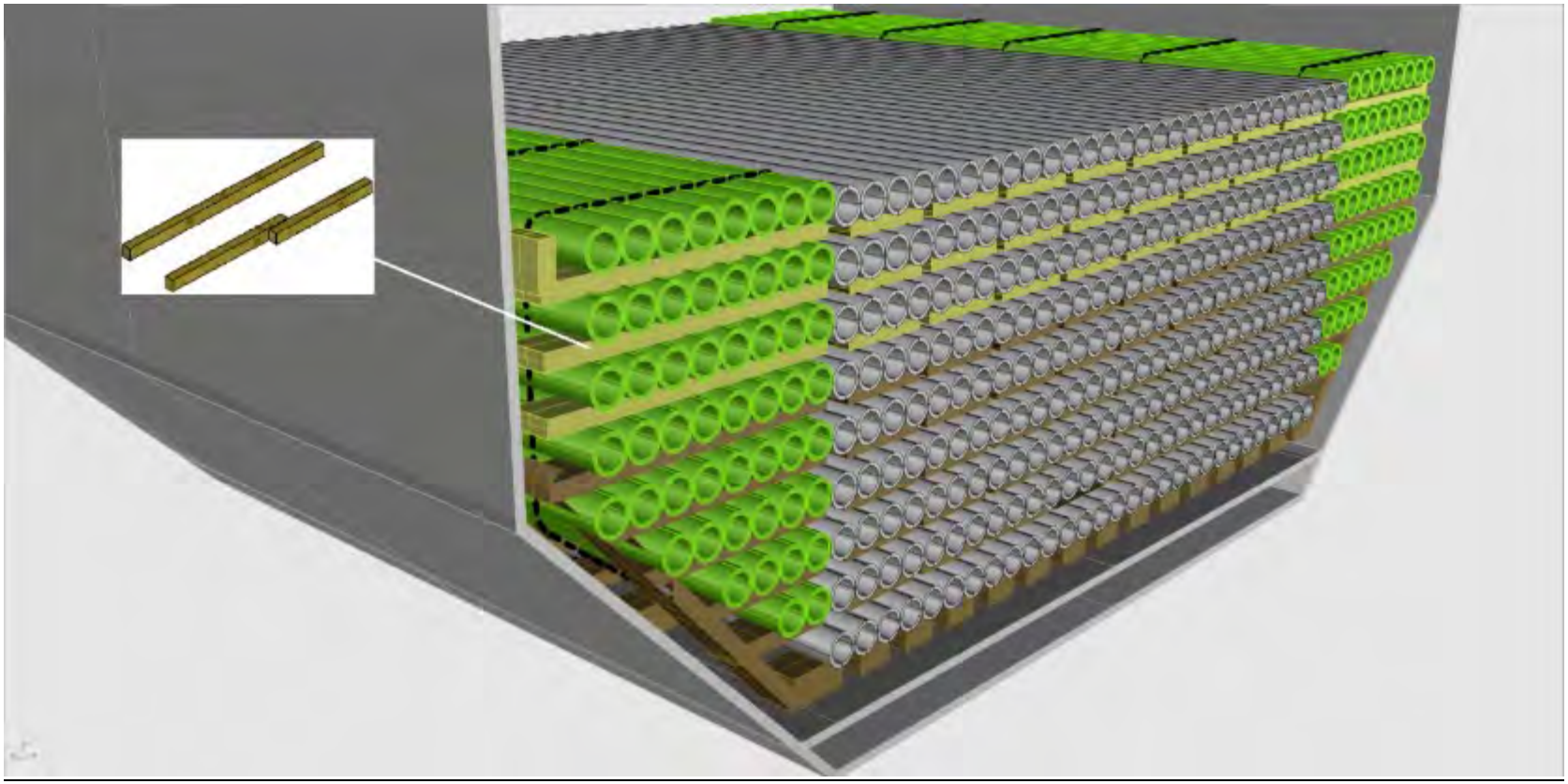
Two uniform stows of pipes. Note that the swaged ends are stowed at opposite ends on alternate layers; the faces are stepped accordingly.

STEEL PIPES

CORRECT STOWAGE, LASHING AND DUNNAGING

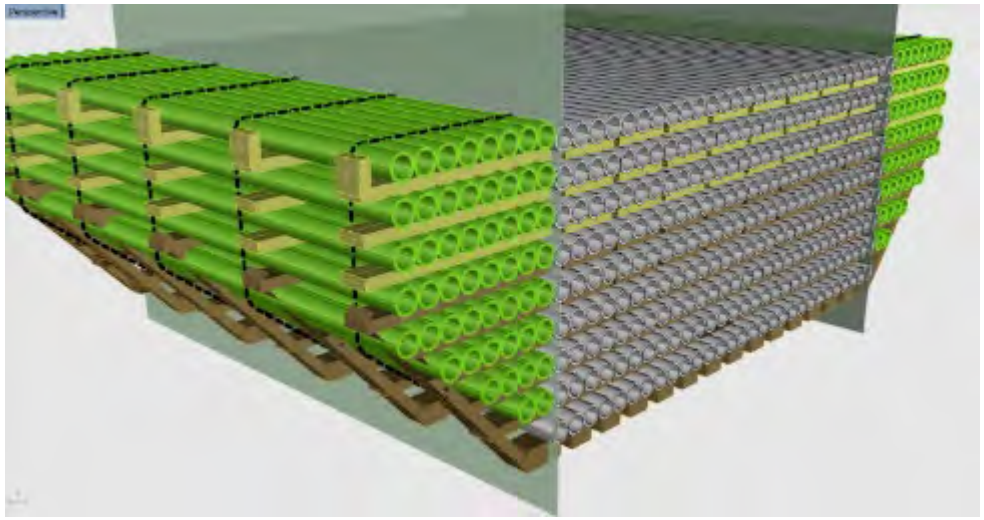
All schematics are indicative.

The first layer of tank-top dunnage shall be hardwood of size 150mm x 25mm. The subsequent 3 tiers of dunnage shall be hardwood of 75mm x 75mm. The dunnage for the subsequent higher tiers shall be softwood of 75mm x 75mm. A minimum of two wires or nylon web straps shall be positioned on the tank-top and passed athwartships at a spacing of approximately 3 metres.

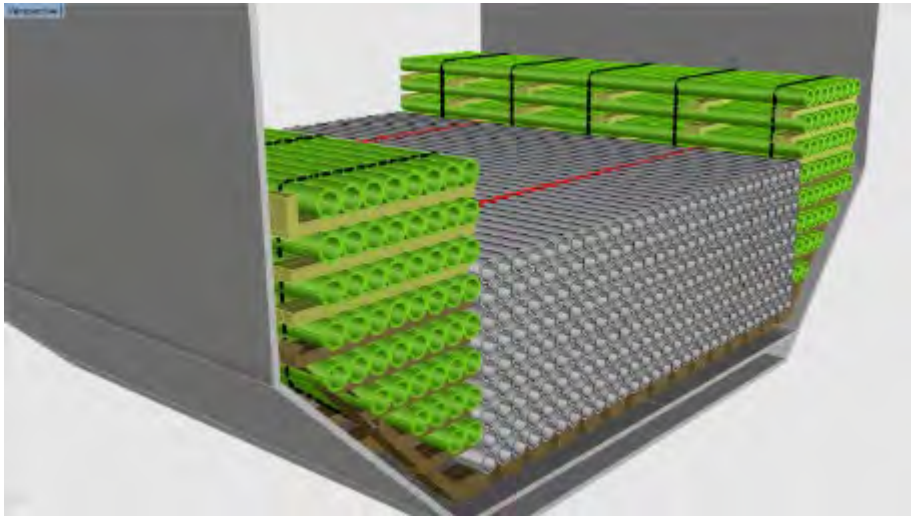


	Under-coaming stow
	Open hatch stow
	Softwood dunnage
	Hardwood dunnage

STEEL PIPES

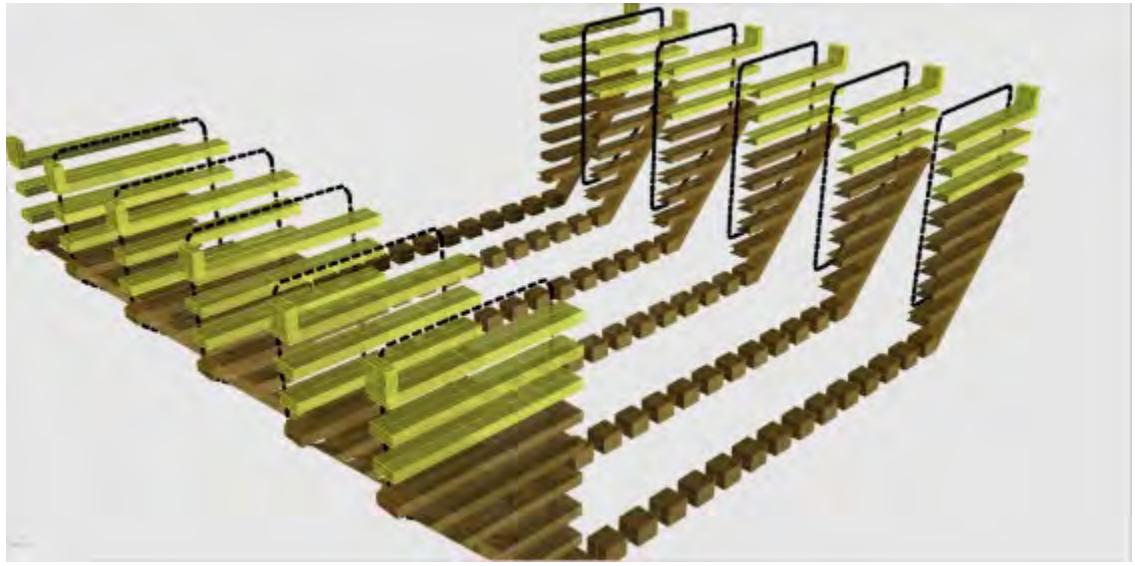


The under-coaming stow is lashed separately to prevent collapse of the stow during off-loading.



The stow under the open hatch is lashed separately and does not require dunnage except for the first tier to avoid contact with the tank-top.

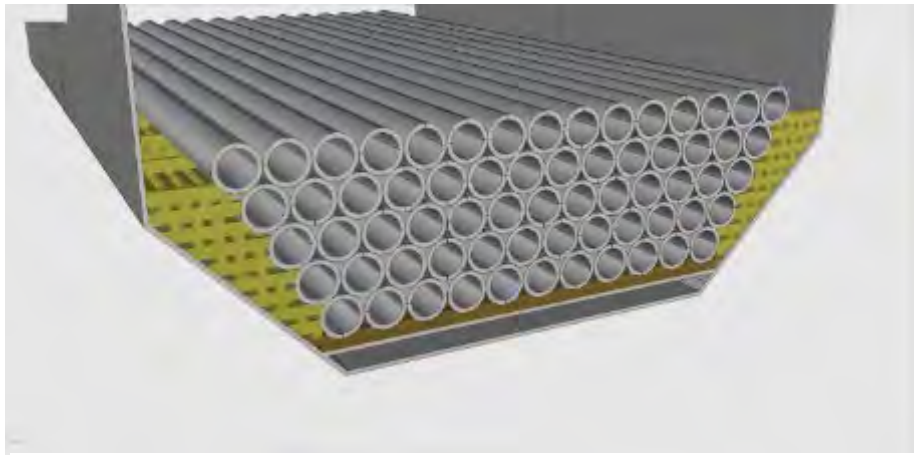
Dunnage and lashing schematics for a stow of pipes. If the stow under the open hatch is pre-slung, dunnage does not need to be used for this part of the stow. Dunnage shall be used for the under-coaming stow, to allow the pipes to be lifted by forklift and moved to an open hatch area.



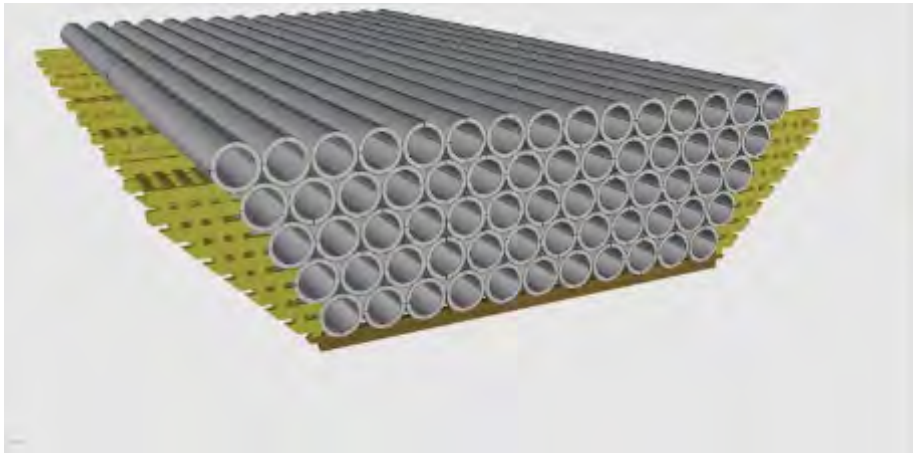
	Under-coaming stow
	Open hatch stow
	Softwood dunnage
	Hardwood dunnage

STEEL PIPES

Indicative schematics of medium or large diameter pipes loaded as a homogeneous stow. Construction of dunnage stool between the stow and the bulkheads. Wooden wedges shall be used on both sides of each pipe from the first tier. For long pipes, three sets of wedges will be sufficient.

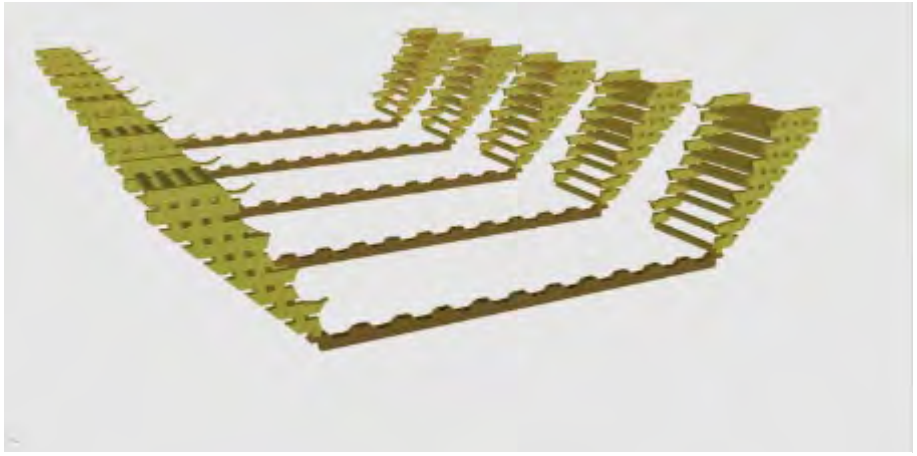


Full stow of longitudinally loaded single pipes. dunnage stool built between the stow and the side bulkheads.



Indicative construction of the pipes stow and the dunnage.

	Under-coaming stow
	Open hatch stow
	Softwood dunnage
	Hardwood dunnage



Indicative schematics of the dunnage stool for medium and large diameter pipes.

STEEL PIPES

Ports use nylon straps, in a basket hitch, and sorting hooks for the discharge of bundled pipes. These are sometimes rigged beneath a spreader, depending on the length of the pipes, or whether the pipes are loose or bundled. For bundled pipes, pre-slinging shall be in place for tip- lifting during the discharge operation. Bundling straps cannot be used for tip-lifting, and sorting hooks cannot be used for overhead lifting.

Ports also use pipe hooks for the discharge of medium to large diameter pipes.

Using pipe hooks for the discharge of 12” open joint steel pipe.

Sorting hooks used to tilt the pipes to allow for the passing underneath of the nylon lifting straps.

STEEL PIPES

A bulk carrier cargo hold in a clean condition ready for loading cargo.

A general cargo carrier with box-shaped cargo holds and pontoon 'tween deck ready for loading.

Poorly prepared cargo hold on a bulk carrier. Residue from some bulk cargoes can react with, and damage, the steel cargo.

Unprepared cargo hold on a bulk carrier. Residue from some cargoes can react with, and damage, steel cargoes.

STEEL PIPES

Pre-slung bundled and packaged pipes on the quay prior to loading. Note: the pre-slings are for tip-lifting only.

12” diameter pipes, bundled in pairs, pre-slung for tip-lifting and using nylon slings for a basket lift of 8 pipes [4 pairs].

Good-quality softwood dunnage boards and wedges to be used on the tank-top or hatch cover. Ideally, the boards would be of 150mm x 25mm cross-section.

Dunnage laid on the tank-top and on subsequent layers of medium size pipes.