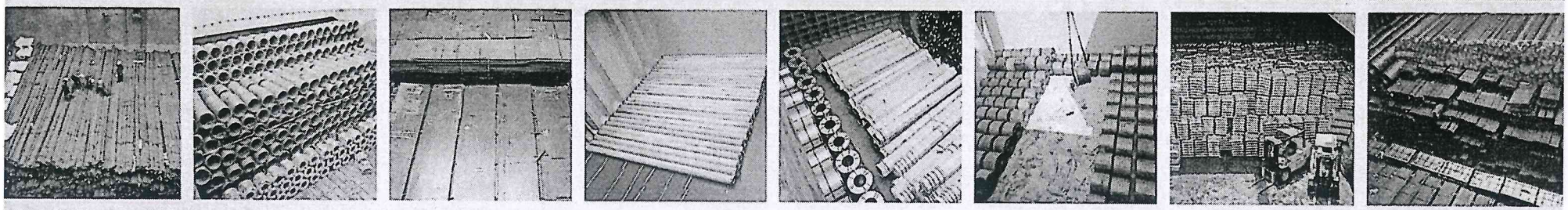
Best Practice Guidelines

for Stowage and Securing of Steel Cargoes



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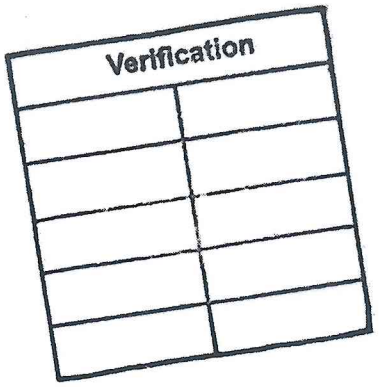

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Background

The International Convention for the Safety of Life at Sea (SOLAS) requires in Chapter VI *'Carriage of cargo and oil fuels'*, Regulation 5 *'Stowage and securing'* 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."

In addition, the International Maritime Organization (IMO) adopted the Code of Safe Practice for Cargo Stowage and Securing (CSS Code) in November 1991 by Resolution A.714(17). The purpose of the CSS Code is to provide an international standard to promote the safe stowage and securing of cargo. 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."

Chapter 2, *'Principles of safe stowage and securing of cargoes'*, states:

"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 principal means of preventing the improper stowage and securing of cargoes is through proper supervision of the loading operation and inspections of the stow."*

Despite these Regulations, the Foreword to the CSS Code highlights that:

"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."

Recognising this safety gap in the steel cargo segment, Capt Leo Vincent of Jurong Port and appointed consultant Capt Ivan Todorov of Brookes Bell developed a set of guidelines, which forms the basis of this publication.

The neighbouring ports of Johor Port, Northport, Westports and Penang Port joined Jurong Port (collectively 'The Ports') in support of the project and, after a comprehensive review of the issues faced by stevedores during the discharging of various steel cargoes, The Ports issued the *'Best Practice Guidelines for Stowage and Securing of Steel Cargoes'*.

The Guidelines have been developed to assist ship's Masters and officers, port Captains, load port agents and stevedores, charterers and shippers when planning to load steel cargoes that are bound for Malaysia or Singapore. However, the Guidelines can be applied to any other ports. They are to be read in conjunction with the respective company's instructions on the safe carriage of steel, ship ISM requirements, advisories found in the cargo stowage and securing manual, and the port's stowage policy.

The primary objectives of these Guidelines are 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 discharge port
- avoidance of damage to the cargo during the cargo handling operation.

The *'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.

Forewords

Jurong Port has been integral to Singapore's development, having served as a multipurpose port to support our construction, shipbuilding, offshore, petroleum and manufacturing industries since its establishment in the 1960s. Through a series of transformation efforts, we have seen Jurong Port grow into a leading multipurpose port in the region and being recognised for its operational efficiency, safety standards and sustainability initiatives.

I commend Jurong Port for having taken the initiative to work closely with regional multipurpose ports and industry associations, such as the Singapore Shipping Association (SSA) and the ASEAN Ports Association (APA), amongst others, to develop a set of best practice guidelines for proper stowage and safe securing of steel cargo on board ships to ensure port workers' safety and to enhance terminal operations' efficiency. These guidelines are an example of Jurong Port's commitment to excellence in operational safety and efficiency, as it strives to achieve its vision to become a Next Generation Multipurpose Port by 2025. I am confident these best practice guidelines would benefit the wider international maritime and port community.

My heartiest congratulations to Jurong Port and its partners for having produced this useful publication to improve port safety standards.

QUAH LEY HOON
CHIEF EXECUTIVE
MARITIME AND PORT AUTHORITY OF SINGAPORE

MPA
SINGAPORE

Much is made of the modern port industry and the vast strides it has taken in improving efficiency and safety. Significantly though, most of the advances in technology and automation concern containerised cargoes. However, there is still a large volume of global trade that simply cannot be containerised and poses a major challenge to those handling it. Steel cargoes, of all types, is one such example.

If steel cargoes are not handled and stowed on board correctly, the consequences can be significant, including delays to vessels, damages to cargo, vessels and handling equipment, and, even worse, serious injuries and loss of life. These are major risks that cannot be underestimated.

Jurong Port's extensive publication offers best practice guidelines that will help the industry to take a significant step forward in improving efficiency and safety in the steel cargo supply chain.

The International Association of Ports and Harbors (IAPH) and the International Cargo Handling Coordination Association (ICHCA) are pleased to be associated with this major publication and commend Jurong Port for its development. IAPH and ICHCA are furthermore committed to support and promote the guidelines and their follow-up actions under the World Ports Sustainability Program (WPSP).

DR PATRICK VERHOEVEN
MANAGING DIRECTOR
INTERNATIONAL ASSOCIATION OF
PORTS AND HARBORS

IAPH

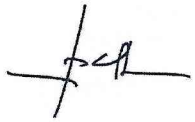
WPSP

CAPTAIN RICHARD BROUGH OBE
HEAD OF ICHCA INTERNATIONAL

ICHCA
INTERNATIONAL

Commitment to Safety

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



Shahrull Allam Shah
Abdul Halim
Chief Executive Officer
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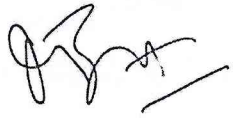

Ooi Boon Hoe
Chief Executive Officer
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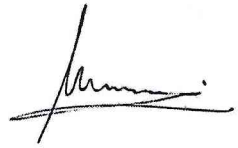
Sasedharan Vasudevan
Chief Executive Officer
Penang Port Sdn Bhd



Eddie Lee Mun Tat
Chief Executive Officer
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Supporters of the 'Best Practice Guidelines for Stowage and Securing of Steel Cargoes'

Agencias Navieras B&R, S.A.S., Dominican Republic

ASEAN Ports Association

Austral Asia Line Pte Ltd, Singapore

Belfast Harbour, Northern Ireland, UK

Brookes Bell, Singapore

Columbia Shipmanagement

Fat Kee Stevedores Ltd, Hong Kong

Golden Ocean Shipping Co Pte Ltd, Singapore

International Association of Dry Cargo Shipowners

International Association of Ports and Harbors

The International Cargo Handling Coordination Association

International Group of P&I Clubs

Johor Port Authority, Malaysia

Maritime and Port Authority of Singapore

Oldendorff Carriers GmbH & Co KG, Germany

OSM Shipmanagement PTE Ltd, Singapore

Port Klang Authority, Malaysia

Sabah Ports Sdn Bhd, Malaysia

Singapore Shipping Association

Solomon Islands Ports Authority

Synergy Group, India

The Nautical Institute

Through Transport Mutual Services (UK) Ltd

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Best Practice Guidelines – Overview

These Guidelines were prepared to address the various operational and safety challenges experienced by The Ports, particularly poor and unsafe stowage but cognisant of the lifting gears used for cargo handling in most neighbouring ports.

These Guidelines include, but are not limited to:

- Specification of the methodology of bundling or packaging each cargo lot and minimum securing arrangements
- detailed dunnage type, quality, dimensions and spacing for different steel products
- a detailed description of good stowage, taking into consideration both cargo care throughout the shipment and the safe and efficient discharging operations at The Ports
- consideration of cargo handling methods and equipment.

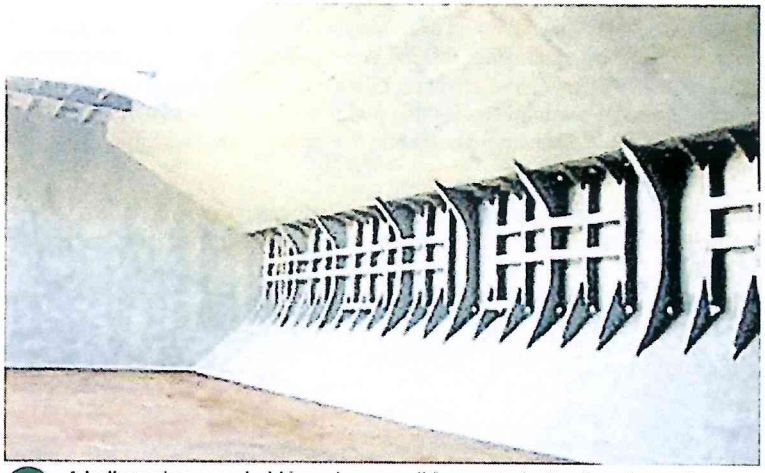
The types of steel cargo addressed are:

- Rebar
- wire rod in coils (WRIC)
- steel plate
- pipes
- structural steel
- hot and cold rolled steel coils
- ingots, billets, blooms and slabs
- combined stowage of different steel products.

The Guidelines provide a general overview for each steel product and then delve into bundling, dunnaging, lashing and stowage, including under-coaming stowage, with schematics where appropriate. The various stages of preparation, loading, stowage, securing and lashing at the loading port are illustrated, including arrival at discharging ports and the subsequent discharging sequences and procedures.

These Guidelines aim to present a storyline for the various cargo stows, with examples to illustrate best practices in action as well as dangerous practices to be avoided.

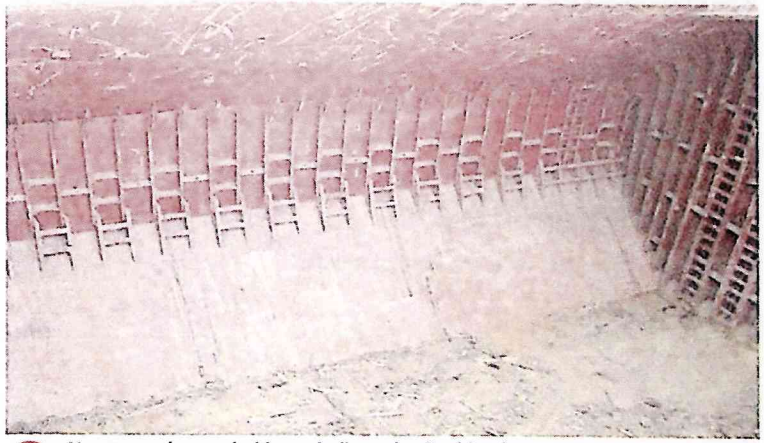
Preparation of Holds for Steel Cargoes (All Types)



A bulk carrier cargo hold in a clean condition ready for loading. Dry and salt-free holds and hatch covers are important factors in prevention of corrosion/rusting

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, steel cargo. A silver nitrate test should be carried out to identify the presence of chlorides



Unprepared cargo hold on a bulk carrier. Residue from some cargoes can react with, and damage, steel cargo and should be cleaned in line with the applicable MSDS requirements

Bundling

Bundling plays a key role in cargo handling operations in ports, particularly for cargoes such as rebar, 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 it is not necessarily safer. Depending on the way the bundling wires are twisted, attention should be paid to the risk of injury.

Generally, for bundling of steel cargo units, wires with bulldog grips, bundling wires and flexible metal bands (straps) are used. The use of bundling wires requires proper twisting of the ends, with at least three twists. The wires must always be sufficiently tightened to provide a compact and tight cargo unit, with consideration given to the weight of the cargo being bundled.

Bundles must 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 transit, which in turn can develop into an unstable stow that is 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 should not be tightened by hand. The ends of the straps should be pneumatically sealed by compressive metal joints. The metal bands may have different width and thickness and these details will be needed when calculating the breaking strength of each steel band. Heavy steel coils, of more than 15 tonnes, for example, may require the straps to be increased in number by up to five or more in transverse orientation. There are usually two to three circumferential straps. 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, which have higher elongation properties than steel bands, may also be used for bundling ingots and billets. The breaking strength of the polyester straps should always be similar to that of metal straps at approximately 2.5 kg/cm^2. Whether using steel or polyester strapping, it is important that they are always used within their working range.

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 discharging operation, which allows lifting slings to be passed underneath the cargo units. In this scenario, a minimum of two double bundling wires with at least four twists should be provided, one at each end and another in the middle, to facilitate the tip-lifting process. The bundling wires, unless specifically certified for this, should never be used for overhead handling and discharging.

The number of bundling wires should 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 bundles of rebar, as this cargo is flexible and easily bent.

Wire rod in coils (WRIC), when unprotected, will be formed into bundles and usually secured with four steel wires or, occasionally, strapping bands. Finished and protected WRIC 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 that each WRIC is bundled by at least five equally spread, double bundling wires. The bundling wires should be secured by at least three twists. The use of five bundling wires will prevent the lower tiers of WRIC from being crushed and will keep the stow tighter without a risk of collapse. If straps are used, five bundles should be made as well.

Small and medium diameter pipes may be bundled together with dunnage to form a single cargo unit that is 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 must be completed before the ship leaves the loading port. The purpose of lashing is to prevent the cargo from shifting, which might endanger the voyage. Steel cargoes, properly stowed, should be secured in a single unified block and, where possible, to the ship's hull or securing points.

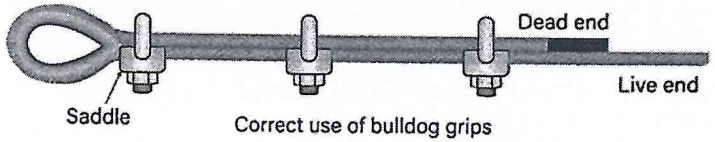
Bulk carriers do not normally have securing points in their cargo holds and the lashing of steel cargoes, on bulk carriers, requires additional care and scrutiny.

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

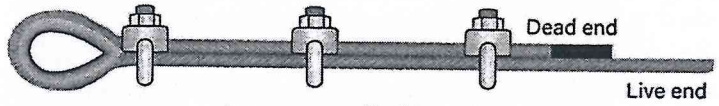
All lashings should conform to the requirements of the ship's cargo securing manual and the CSS Code. A lashing and securing plan should be prepared prior to the loading of the steel cargo and, where required, accompanied by relevant calculations showing the maximum expected forces during the voyage. The Master should be provided with certificates for all lashing equipment used.

The American Club, in their publication *'Transport Guidance for Steel Cargoes'*, considers that, for ease of use, 16 mm (6 × 12) wires with bulldog clips, turnbuckles and shackles would normally be used to lash steel cargoes.

For wires of up to 19 mm diameter, when forming an eye with or without a thimble, a minimum of three bulldog grips should be used at a spacing of approximately six times the diameter of the wire. An allowance of approximately five times the diameter of the wire should be made between the last bulldog grip and the loose end of the wire. The saddle of the bulldog grips should be on the live (load-bearing) wire. The bolts should be tightened sufficiently to compress the wire to ⅔ of its nominal diameter. The wires should be tightened by rigging screws (UK P&I Club *'Best Practice: The Application of Bulldog Grips'*).



Correct use of bulldog grips



Incorrect use of bulldog grips

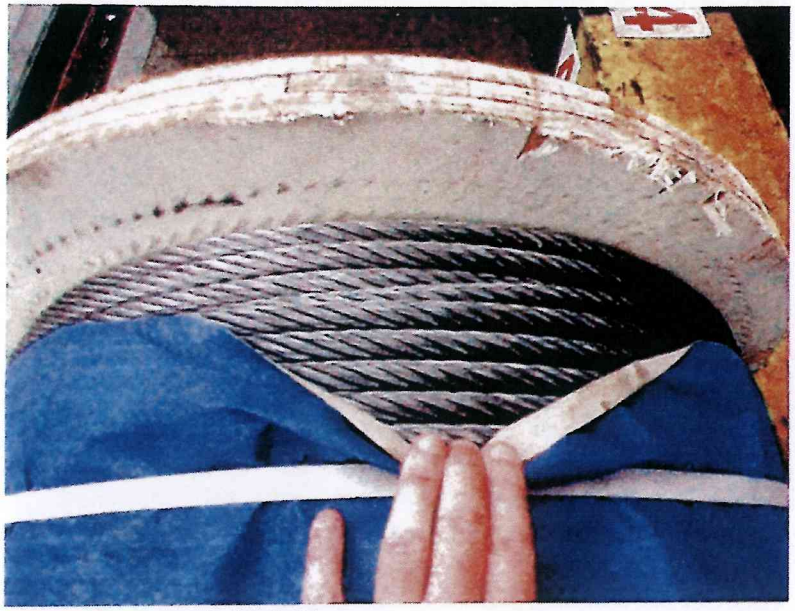
Diameter of wire ropes (mm)	Bulldog grips (Number)
Up to and including 19	3
Over 19: up to and including 32	4
Over 32: up to and including 38	5
Over 38: up to and including 44	6
Over 44: up to and including 56	7

Source: UK P&I Club *'Best Practice: The Application of Bulldog Grips'*

The publication *'Thomas' Stowage'* suggests that the minimum number of bulldog grips is as follows:

- For wires between 12 mm and 17 mm – a minimum of 4 grips
- for wires between 19 mm and 24 mm – a minimum of 5 grips
- for wires of 25 mm and more – a minimum of 7 grips.

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



16 mm wire rope supplied for lashing cargo

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

With respect to 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 ship. The plan, and subsequently the lashing of the cargo, must be carried out to the satisfaction of the Master. The Master should also take into consideration the expected weather en route and ensure the selected lashing material is appropriate.

All relevant documentation and certification for the lashing equipment used should be provided to the ship's Master prior to, and on completion of, the lashing activity.

Bulldog grips and additional 'D' rings for cargo lashings

Dunnage

Dunnage in shipping broadly refers to an inexpensive material used to secure cargo when stowed in the vessel's cargo holds. For the purpose of this publication, the term 'dunnage' refers only to wood, timber and lumber. Only IPPC (International Plant Protection Convention) certified dunnage should be used, and the shippers should provide a relevant fumigation certificate.

Dunnage plays an integral role during the loading, transportation and discharging of steel cargoes because it:

- 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 discharging
- allows access for the tangs of forklift trucks without causing damage.

The dunnage 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 properly certified in accordance with ISPM 15 *'Regulation of wood packaging material in international trade'*. Hardwood dunnage should be used at the tank-top and throughout the first six tiers of rebar, primarily to withstand the cumulative weights of all tiers above.

Different cargo types require specific dunnage by size, shape and structure, and this is addressed in the 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 on top of 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, reducing the tendency of the cargo to shift during the voyage.

Dunnage must be laid athwartships or in the fore-and-aft direction, but always perpendicular to the direction of the cargo units. Prior to loading cargo, dunnage should be laid on the tank-top in sufficient quantity 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 also depends on the steel cargo being loaded. Where possible, gaps should be provided between laid dunnage to allow for any water ingress to be directed towards the bilges.

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

Certain steel cargoes, such as steel coils, large diameter pipes and structural steel, may require additional dunnage constructions to be built to prevent 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 for the size and type of the dunnage to not be in accordance with these Guidelines. If this is the case, more dunnage may be required to achieve the desired result for a good block of cargo stow.

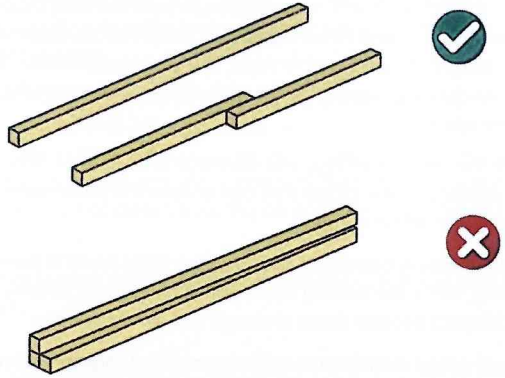
Certain cargoes, such as WRIC, ingots in bundles and T-ingots, are better stowed using plywood boards. The relevant sections provide further information.

If the dunnage is not dry, it may produce moisture in the cargo compartment. Dunnage with a moisture content of more than 14% should not be used.

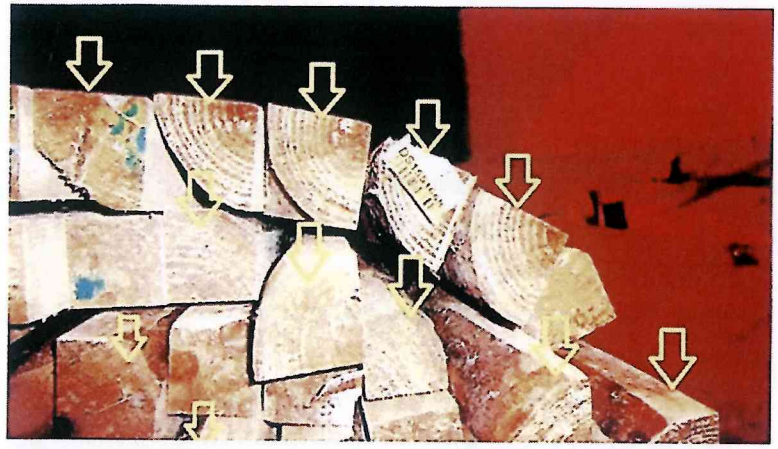
When loading heavy cargo units, the dunnage may become crushed and the cargo may shift or be damaged. At the discharging port, crushed dunnage pieces present a safety hazard for the stevedores and make it difficult for them to handle the cargo during the discharge operation.

These Guidelines make reference to both hard and soft wood dunnage. While the species of woods used as dunnage are numerous, a basic rule is that the hardwood type of dunnage should not crush under the weight of the cargo units.

The differentiation between hard and soft wood, for use 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 the *'Uniform Standard for Wood Pallets'* which 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 should also be certified as soft/hardwood or with high, medium or low density.



Only square one-layer dunnage should be used. Double-stacked, rectangular dunnage or a 1 on 2 stack dunnage arrangement must not be used



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

Stowage

All cargo should be stowed in accordance with the IMO Code of Safe Practice for Cargo Stowage and Securing (CSS Code). The stowage is usually started with planning and cargo distribution. The planning process should consider and include the dunnage layout on the tank-top and between the layers (tiers) for each steel parcel.

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

During the loading operation, the stowage goes hand in hand with the dunnaging, while the lashing operation is a separate activity that is often carried out by different people. Good stowage will aim to ensure:

- Proper cargo distribution, with respect to geographical rotation and sequence of loading and discharging
- correct load distribution with respect to the whole ship
- correct load distribution within each individual cargo compartment
- prevention of damage or deformation to the cargo
- prevention of damage to the ship's cargo compartments by avoiding direct contact between the steel cargo and the ship's structure
- good segregation of various parcels
- correct ventilation of the cargo on board
- efficient loading operation
- stability of the stow at sea during all weather conditions
- efficient discharging operation
- safe cargo handling operation at both the loading and discharging ports
- the cargo is delivered to the receivers in the same apparent good order and condition as it was when loaded on board.

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

General cargo ships are characterised by having single cargo hold compartments or 'tween decks and lower holds. They usually have box-shaped cargo compartments that facilitate stowage and cargo handling. There are also designated securing points, which are not common on bulk carriers.

Bulk carriers have hopper-type, double-bottom water ballast tanks, resulting in a sloped shape for 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 have different strength characteristics than the tank-top and this fact should be well known by the ship'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 of the tank-tops and hatch covers and on the stowage factor of the cargo. The loading limits are determined by the shipyard and confirmed by the Classification Society and are usually stated in the ship's loading manual, capacity plan and cargo securing manual.

It should be remembered that this limit will have been calculated when the ship was new and 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.

While the majority of bulk carriers have bottom and top side ballast tanks, some of the modern general-purpose bulk carriers are constructed with double-sided water ballast tanks (or with double hulls). This construction results in box-shaped cargo compartments without hopper areas, which significantly assists the handling of steel cargoes. When steel cargoes are stowed 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 ship's hull structure if possible. The ship should never proceed to sea with an unfinished last tier of cargo, particularly where the cargo units are heavy. Lashing, dunnaging, chocking and securing of an unfinished last tier can be challenging and may not provide the necessary stability and guarantee from shifting in adverse weather conditions.

For combined stows of different steel cargoes, it is important 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 steel cargoes, semi-finished cargo units, which are normally unwrapped and kept in the open, may 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. The moisture given off the wet semi-finished products may affect the condition of the finished products.

Sometimes, segregation is difficult to achieve. However, depending on the apparent condition of the semi-finished goods, the Master and the crew should aim to address 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 discharging 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 ship's departure from the first discharging port.

The IMO CSS Code and MSC.1/Circ.1353/Rev.1, Revised Guidelines for the Preparation of the Cargo Securing Manual, set out provisions for cargo safe access plans for ships 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 amended by the 1988 Protocol.

Each ship should ensure the safe access of personnel to the relevant stows of cargo in the cargo compartments at any time the ship is at sea or in port. A ship's specific plan should be prepared by the crew based on the cargo parcels to be loaded, and the access points should be presented and discussed with the stevedores prior to the commencement of the cargo discharging operation.

Under-coaming

All cargoes are discharged 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 easily be damaged if they come into contact with the coamings and their edges. This may also cause the cargo to swing, once lifted, risking damage to the cargo or the ship's structure, or personal injury to stevedores.

The Ports use forklift trucks to move cargo from the under-coaming areas into the hatch square, where plumb-lifting by crane or derrick may be carried out 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.

References

IMO – International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended

IMO – Code of Safe Practice for Cargo Stowage and Securing (CSS Code), 2011, as amended

ILO – Code of Practice – Safety and Health in Ports, 2016

ILO – Register of Lifting Appliances and Items of Loose Gear, 1985

UK MCA – Code of Safe Working Practices for Merchant Seafarers (COSWP), 2018

UK HSE – Port Skills and Safety – Health and Safety in Ports, SIP002 – Guidance on General Cargo, 2016

Singapore WSH Council – Code of Practice on Safe Lifting Operations in the Workplaces, 2014

Singapore WSH Council – Guide to Safe Use of Overhead Travelling Cranes, Gantry Cranes, Jib Cranes and Hoists, 2016

Singapore – Workplace Safety and Health (Operation of Cranes) Regulations, 2011

AMSA – Marine Order 32 (Cargo Handling Equipment), 2016

Safe Work Australia – Working Safely with General Cargo – Steel Products, 2009

Maritime New Zealand – Maritime Rules, Part 24B: Carriage of Cargoes – Stowage and Securing, 2016

Thomas' Stowage: The Properties and Stowage of Cargoes, 8th Edition, 2018

The American Club – Transport Guidance for Steel Cargoes, 2016

Gard – The Carriage of Steel, 2013

NOE P&I – Cargo Stowage and Securing, 2nd Edition, 2007

Skuld – Carriage of Steel Cargoes, 2008

The Standard Club – A Master's Guide to the Carriage of Steel Cargo, 2nd Edition, 2019

UK P&I – Carriage of Steel Cargo

UK P&I – Securing Shipments of Steel by Flexible Metal Bands

UK P&I – Stowing and Securing Steel Slabs

UK P&I – Hot Rolled Steel Sheeting

UK P&I – Best Practice: The Application of Bulldog Grips

UK P&I – Preparing Cargo Plans – Structural Limitations

UK P&I – Lashing and Securing Deck Cargoes

UK P&I – Carefully to Carry, Consolidated Edition 2018, September 2017

The Nautical Institute – Bulk Carrier Practice, 2nd Edition, 2010

LIU – Minimising Loss in Prefabricated Steel Shipments, 2017

Lloyd's Practical Shipping Guides, Steel: Carriage by Sea, 5th Edition, 2009 (A Sparks and F Coppers)

JIS – Stowage and Lashing of Steel Coils

ISPM 15 – International Standard for Phytosanitary Measures, Regulation of Wood Packaging Material in International Trade, 2017

National Wooden Pallet and Container Association – Uniform Standard for Wood Pallets, 2014, as revised

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Rebar

General

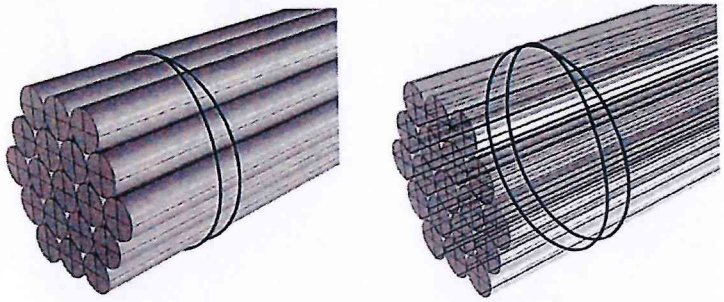
Rebar, or deformed high-tensile steel bar, is hot rolled and is typically stored in the open. It is shipped in unprotected bundles that are secured by lengths of steel bundling wire bands wrapped around the bundles at intervals, with the ends twisted together. The bundling wires hold no strength and must not be used for overhead lifting. However, the 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 metres in length. For example, the 12 metre bundle is the most commonly imported length at Jurong Port and it weighs approximately 2 tonnes.

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

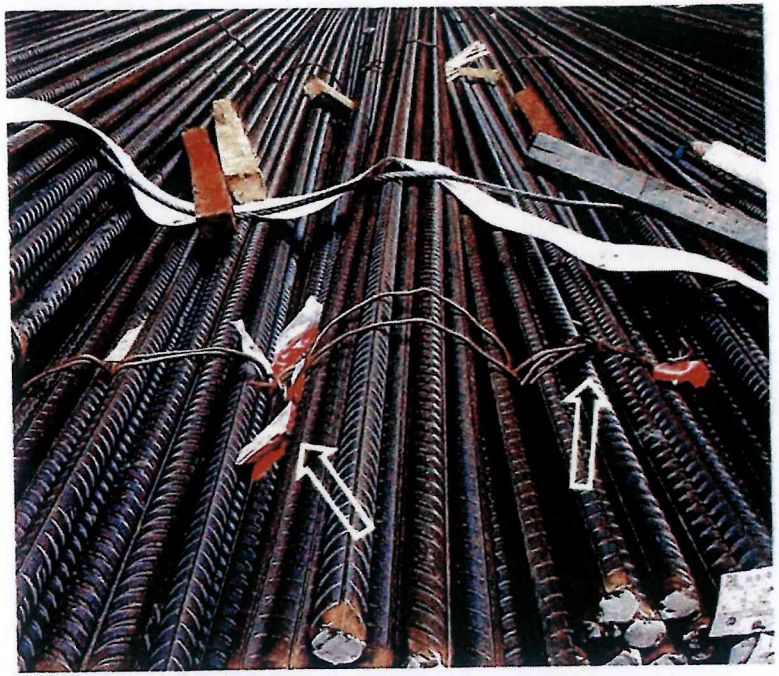
Bundling wires along the length of the bundles are not designed for lifting, but can be used for tipping

Bundling

Bundling wires should be at least 6 mm size. As a minimum, the two end and middle bundling wires should be doubled. Each bundling wire should be spaced, depending on the length of the rebar, at intervals of approximately 1.7 to 2.2 metres and at 0.5 metres from the ends. A 6 metre rebar bundle should 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 should be securely twisted at least three times to provide strength for tipping of the bundles. Proper and effective bundling helps with tip-lifting and maintains tight bundles of rebar when handled with slings and forklifts.

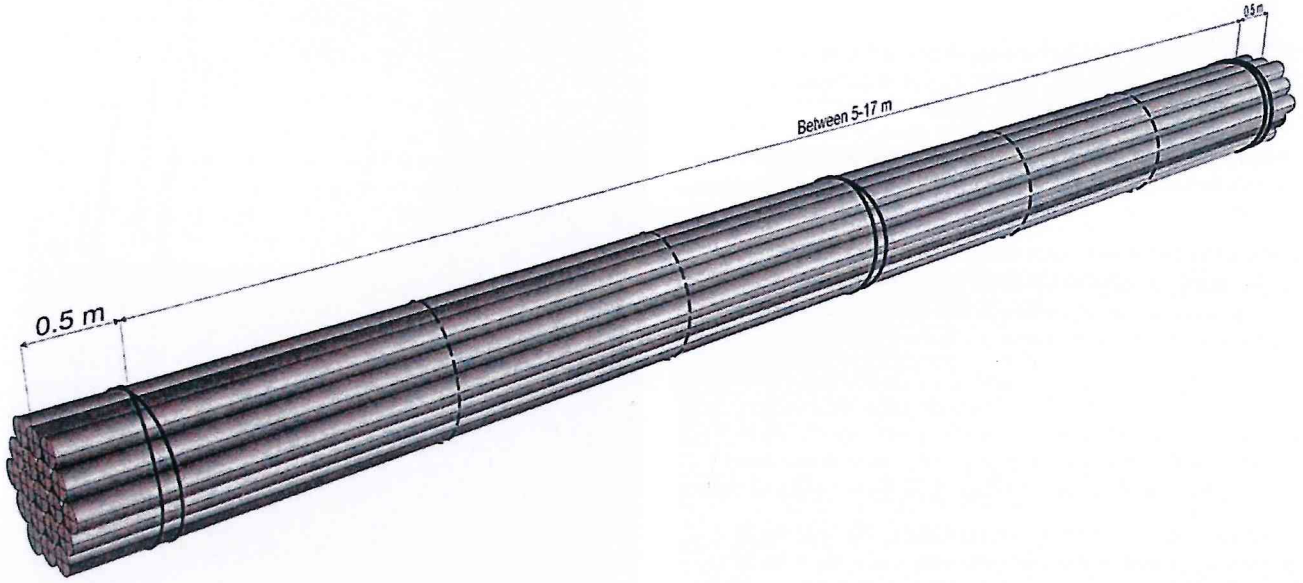


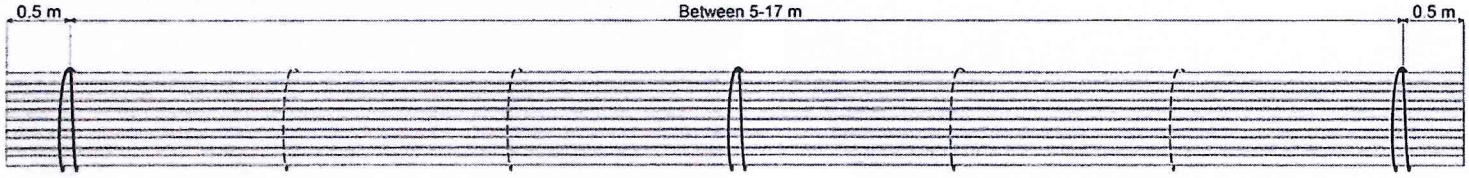
Double bundling wire



Double bundling wires used. Insufficient and incorrect securing twists – a minimum of three twists is required

Rebar





Bundling rebar 6 to 18 metres in length
Three double bundling wires should be made, one at 0.5 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 rebar.

Dunnage

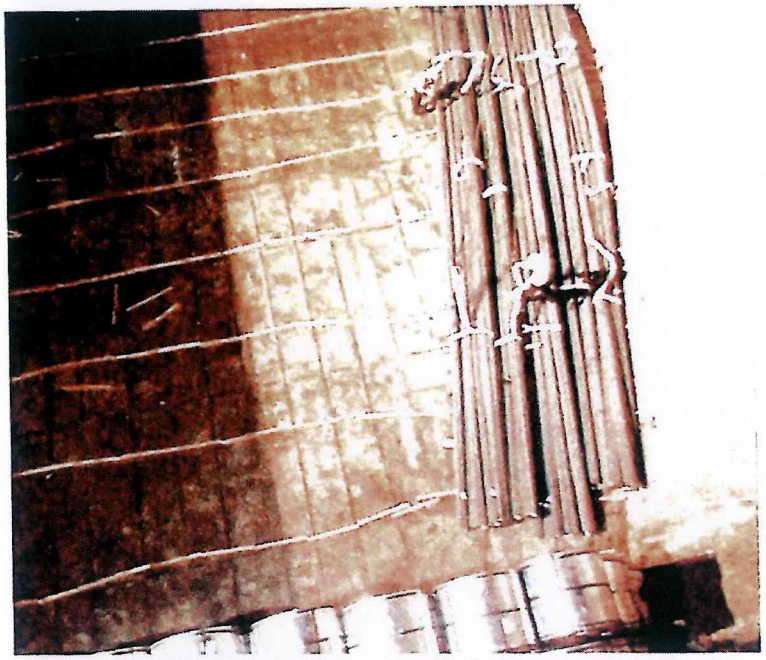
Many steel cargoes will shift if not correctly dunnaged as there is very little friction between steel products laid directly on top of each other. However, this is less the case for rebar because of its deformed nature.

Good, dry, bark-free, hardwood dunnage should be used at the tank-top and throughout the first six tiers of rebar. For the subsequent tiers, soft wood dunnage may be used.

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

The first layer of tank-top dunnage should be of hardwood, size 100 mm × 100 mm. The subsequent six tiers of dunnage should be hardwood of 75 mm × 75 mm. The dunnage for the subsequent higher tiers should be of soft wood 75 mm × 75 mm. The rebar should be stowed in level tiers, not in a pyramid stow.

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

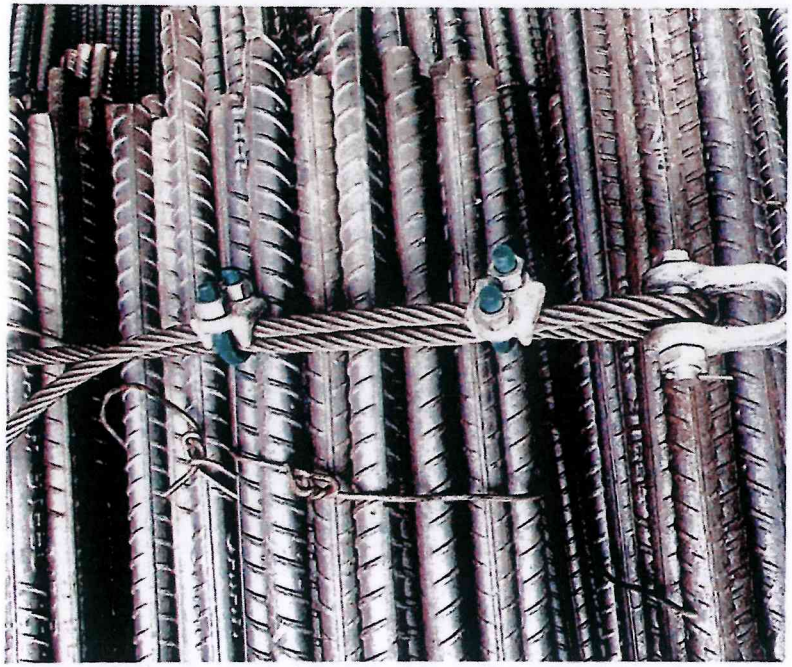


Loading of pre-slung rebar. The spacing of the tank-top dunnage should not exceed 3 metres. In the photograph, the spacing is approximately 2 metres

Lashings

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 should be tight and well made. The Master should be supplied with certificates for all lashing equipment used.

An appropriate number of lashing wires should 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, although a minimum of 2 per 6 metre length or a minimum of 3 per 12 metre length of bundle would be considered reasonable.



Insufficient number of grips used and the saddle is not on the live wire

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

Rebar

Stowage

Where there is more than one parcel for various consignees, or if there are 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 ship's departure.

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 load limit determined by the shipyard and confirmed by the Classification Society when the ship was built. It should be remembered that this limit was calculated when the ship 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.

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 should be taken to ensure that there is no steel-to-steel contact with the ship's structures. An athwartship stow of rebar 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 common structural arrangement. The dunnaging of such a mixed stow will be 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.

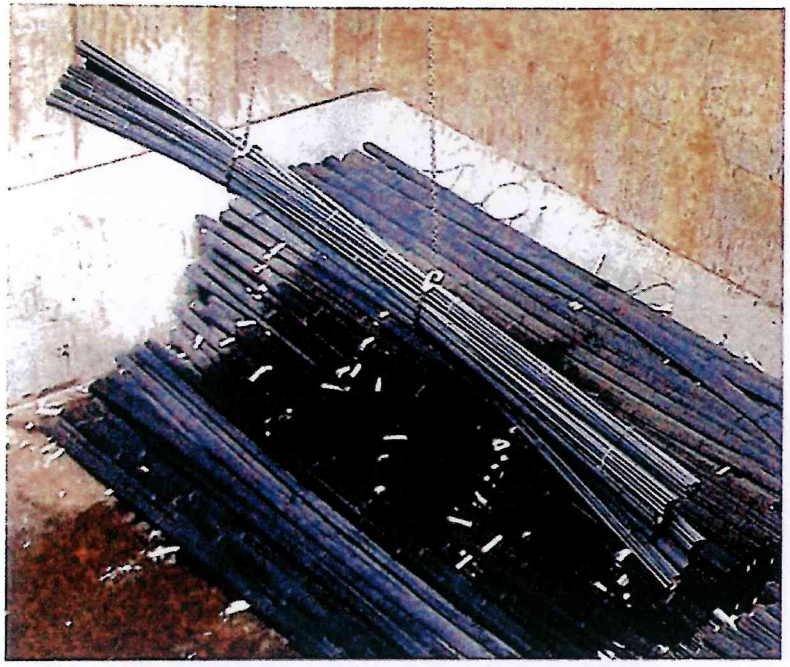
In the event of two separate stows of rebar in one cargo compartment, there should be a minimum of 1 metre clearance between the forward and aft stow.

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

Rebar

Ports typically use Grade 100 chains, of 10 tonne SWL with a 'choke hitch.' This means they can handle 6 or 7 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.



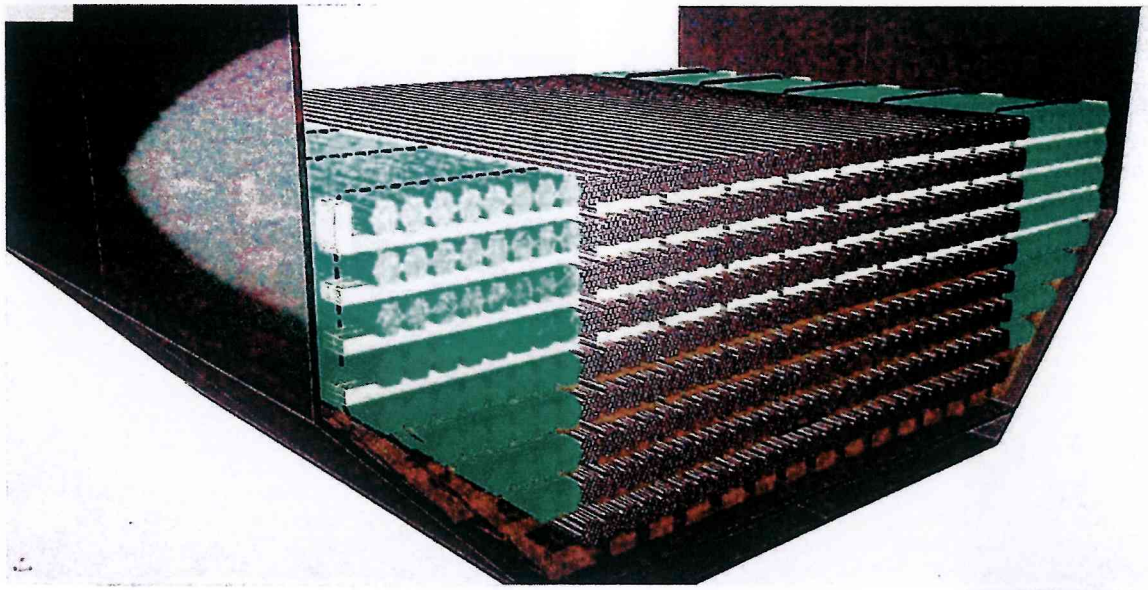
An application of the two-leg chain choke hitch around the bundles

Tip-lifting technique used for discharging rebar

Correct Stowage, Lashing and Dunnaging

All schematics are indicative.

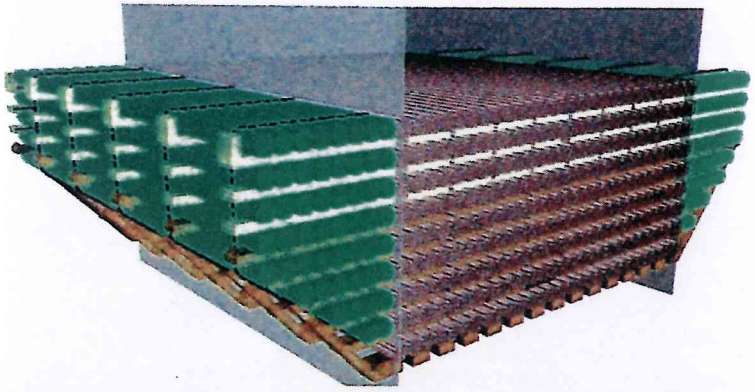
The first layer of tank-top dunnage should be of size 100 mm × 100 mm. The subsequent six tiers of dunnage should be hardwood of 75 mm × 75 mm. The dunnage for the subsequent higher tiers should be of soft wood 75 mm × 75 mm. A minimum of 2 wires positioned on the tank-top and passed athwartships per 6 metre length of bundle, or a minimum of 3 per 12 metre length, would be considered reasonable.



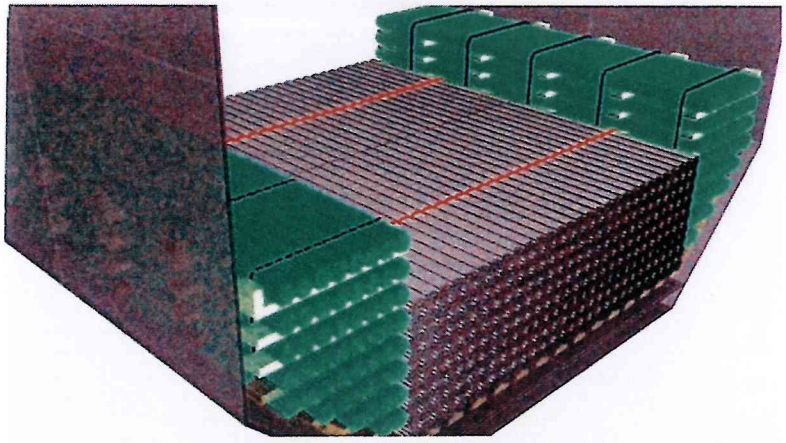
	Under-coaming stow
	Open hatch stow
	Soft wood dunnage
	Hardwood dunnage

Rebar

Dunnage and lashing to be used for a stow of rebar.



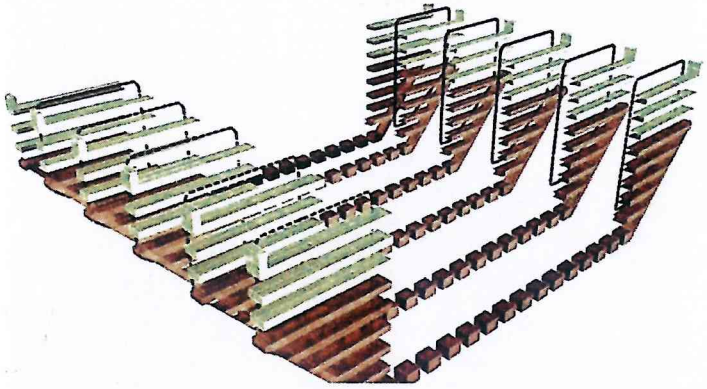
The under-coaming stow is lashed separately every 2 metres in height to prevent collapse of the stow during cargo handling

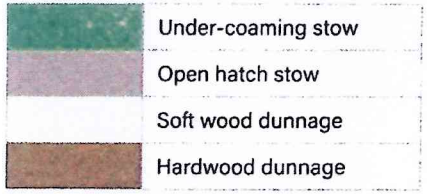


The pre-slung stow under the open hatch is lashed separately and does not require dunnage, except for the first tier to avoid contact with the tank-top

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

If the stow under the open hatch is pre-slung, dunnage may not be used for this part of the stow. Dunnage should be used for the under-coaming stow.





Rebar

All cargoes are discharged by vertical lift only. Ports may not use the lifting gear to drag cargo from the wing spaces to the open hatch square. Forklift trucks are utilised to facilitate the discharging of such cargo.

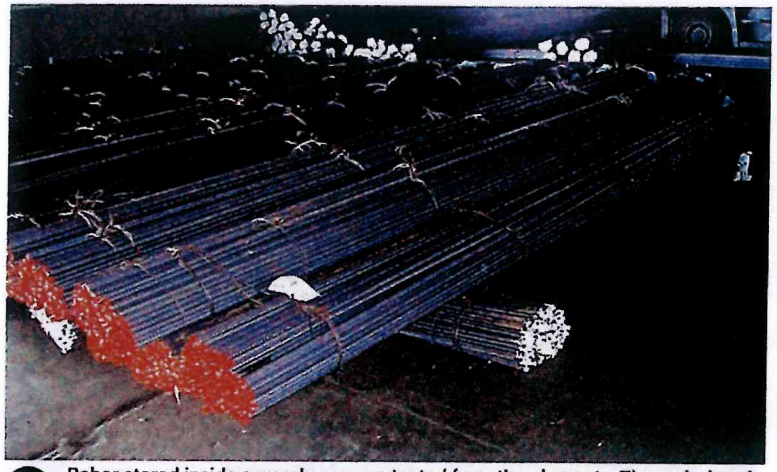
Rebar stowed under the coamings by forklift trucks, prior to loading in the hatch square

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

Dunnage and lashing wires are pre-laid on the tank-top, with additional dunnage between the subsequent tiers of rebar

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



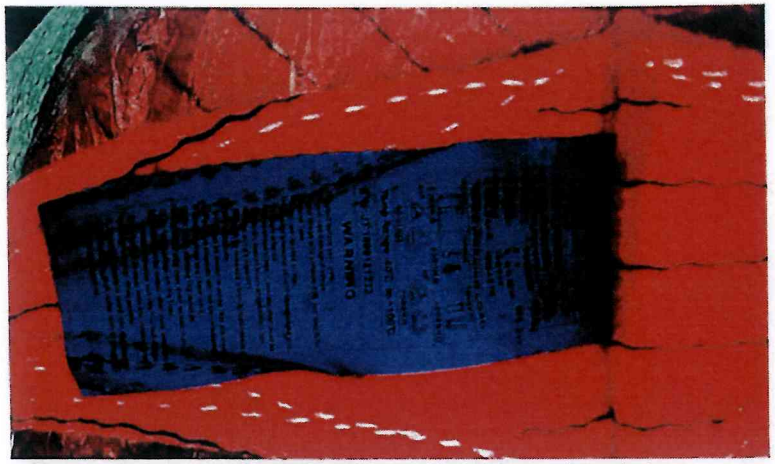
Rebar stored inside a warehouse, protected from the elements. The majority of the stow is raised above any possible standing water

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

Pre-slinging of two tiers of rebar in preparation for loading

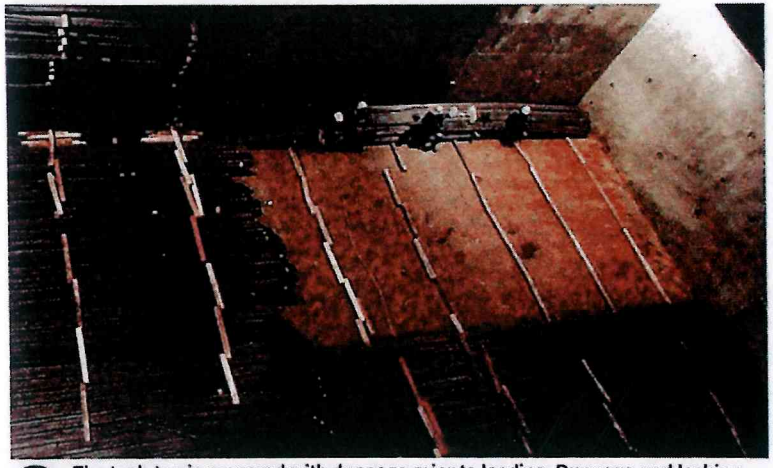
Rebar

A sling combining six bundles of rebar ready for loading



The slings for pre-slinging should be certified and properly marked

Lifting bundles by the bundling wires can lead to loosened 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 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 also use dunnage. However, dunnage is not required for this area when rebar is pre-slung, except for the under-coaming areas

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

Rebar

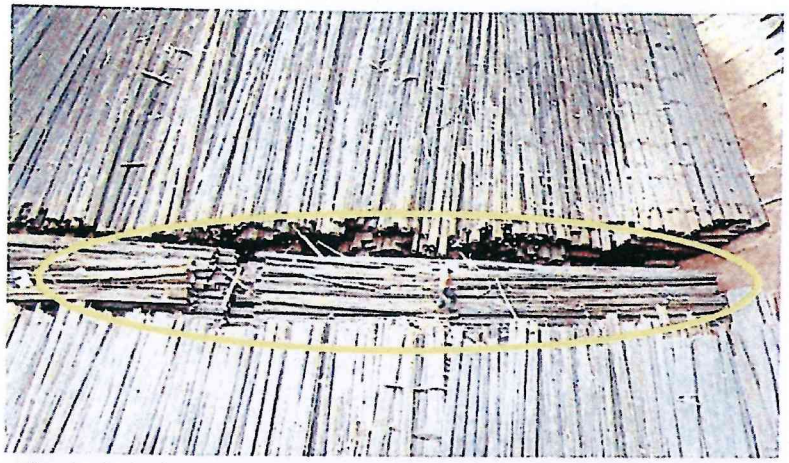
It is acceptable to stow other cargoes, pipes, steel plates, etc. on top of properly stowed and secured rebar as long as it is not required to be re-stowed to allow discharge of the rebar

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

Steel plates must not be stowed on top of rebar. Refer to the combined stow guidelines. However, rebar 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

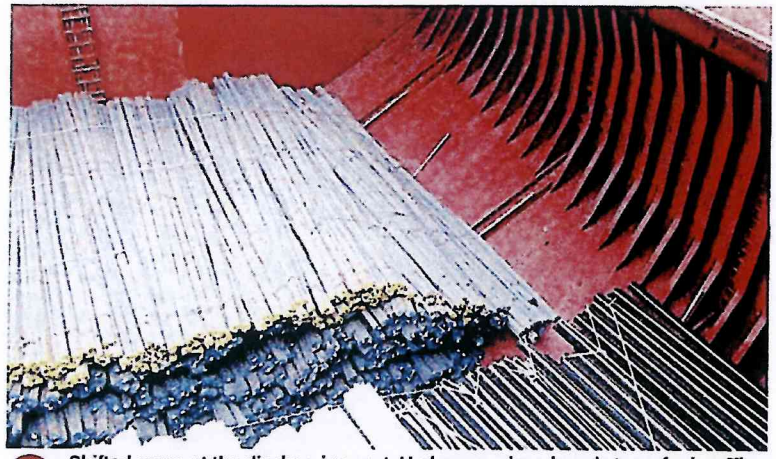
Rebar



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

12 metre long rebar 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 12 metre long rebar without dunnage. Shifting of the rebar inside the under-coaming space



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

Rebar

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

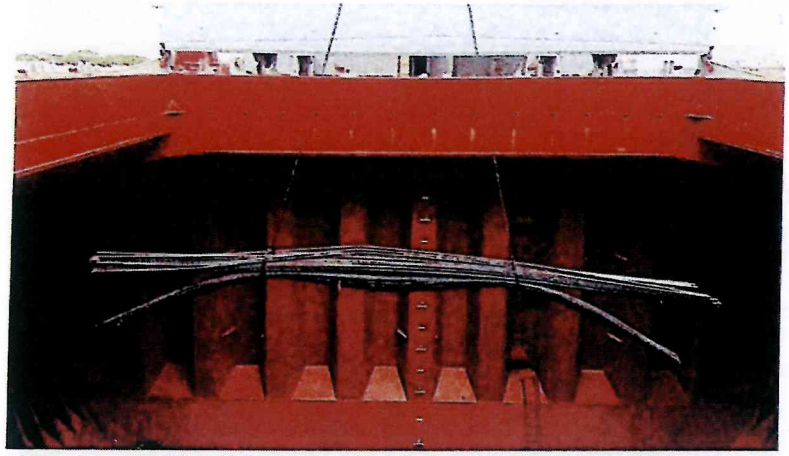
Tipping hooks

Tip-lifting from the end of the rebar bundles

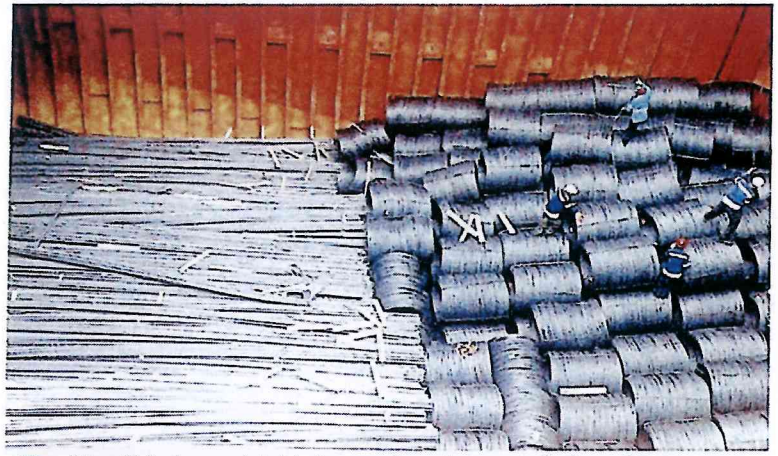
Lifting the middle part of the rebar bundle, with the use of a wire, to pass the choke hitch sling. The dunnage assists in passing the lifting wire underneath

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

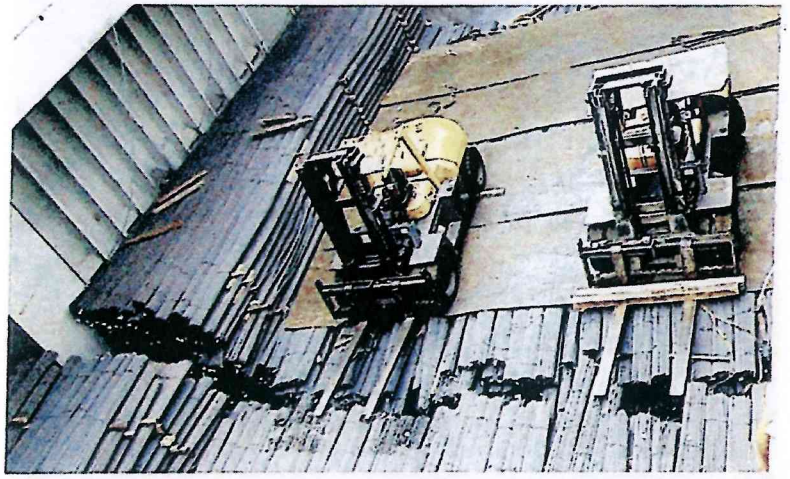
Rebar



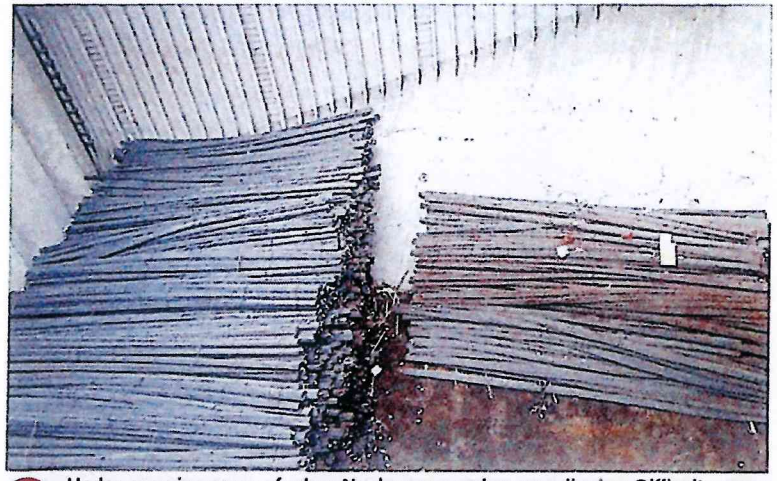
Once the lifting chains are attached, the bundles can be safely discharged



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

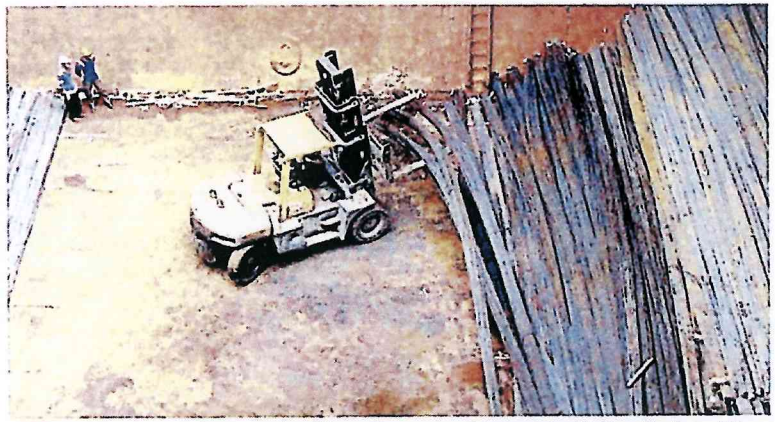


During discharging, forklift trucks should be used to access the under-coaming cargo. The dunnage assists in swift operation and damage prevention

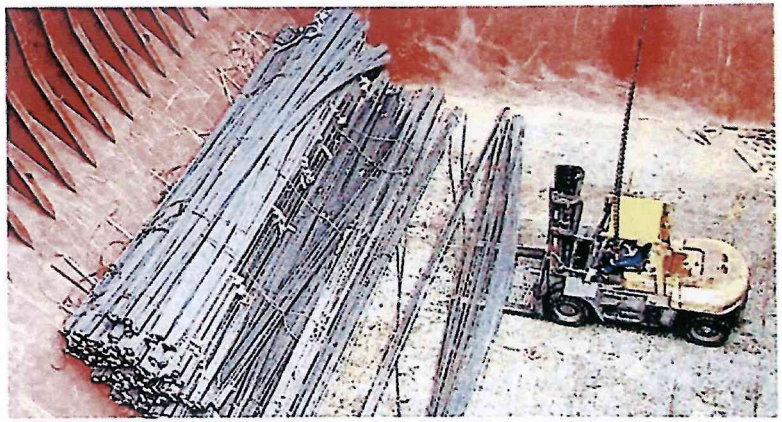


Under-coaming cargo of rebar. No dunnage and no pre-slinging. Difficult access to the upper tiers and handling by forklift trucks

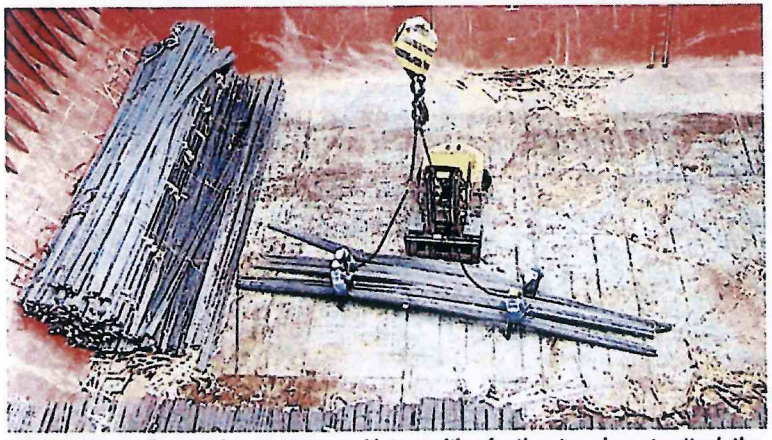
Using a forklift truck to position the bundles under the hook.



Further down the stow, forklift trucks are used to assist with the slinging of the bundles. However, 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 manoeuvred into position for the stevedores to attach the slings

Once discharged from the ship, the rebar is handled by forklift trucks

Notes

- ☐ 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 dunnage not to exceed 3 metres.
- ☐ The first layer of dunnage on the tank-top is to be hardwood, with a minimum cross-section of 100 mm × 100 mm.
- ☐ Dunnage between layers to be laid to assist with slinging at discharging ports.
- ☐ 75 mm × 75 mm hardwood dunnage for the first six tiers of rebar. For subsequent tiers, soft wood dunnage of similar dimensions may be used.
- ☐ Dunnage is required for the under-coaming space areas. If the rebar within the open hatch area is pre-slung, 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 discharging of the open hatch stowed cargo.
- ☐ All tiers to be stowed level, with the face of the stow to be as straight as possible and with sufficient clearance from the adjacent stow to prevent virtual over stows.
- ☐ In the cargo compartments, where possible, safe passage should be provided directly from the ladders to the top of the cargo stow. In bulk carriers, this access should be provided directly from the Australian ladders. Safe access should also be provided from the tank-top to the top of the cargo stow.

Wire Rod in Coils (WRIC)

Wire rod in coils (WRIC) is 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 and these will be wrapped and protected to avoid damage by handling and moisture ingress.

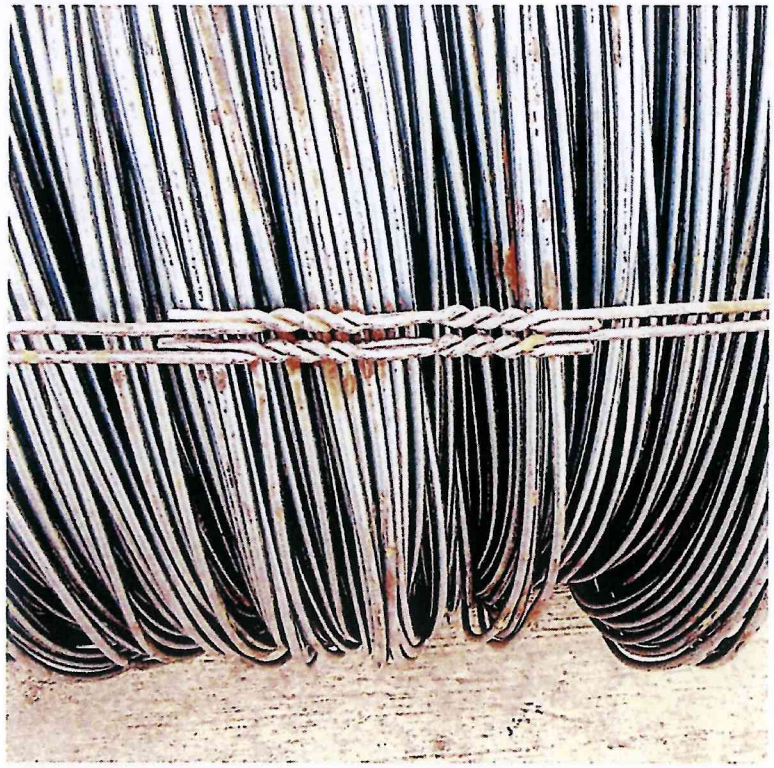
WRIC comes in various sizes and grades. For example, an established UK steel manufacturer offers rod with diameters from 5.5 to 16 mm, with coil weights ranging from 500 to 2,200 kg. Coil lengths vary from 1,350 to 1,700 mm, with a maximum outside diameter of 1,250 mm.

Bundling

WRIC, when protected, 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 must not be used for this purpose.

Each unprotected WRIC should be bundled by at least five, equally spread, double wires. The bundling wires should be secured by at least four twists. The use of five bundling wires will prevent the lower tiers of WRIC from crushing and will keep the stow tighter without a risk of collapse. If straps are used, five bundles should be made as well.

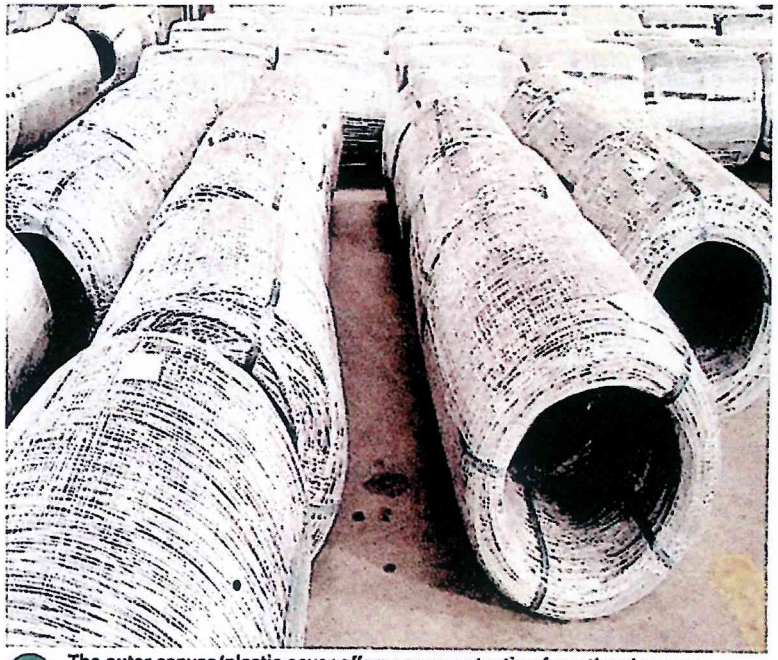
Each bundling wire should be at least 6 mm diameter.



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

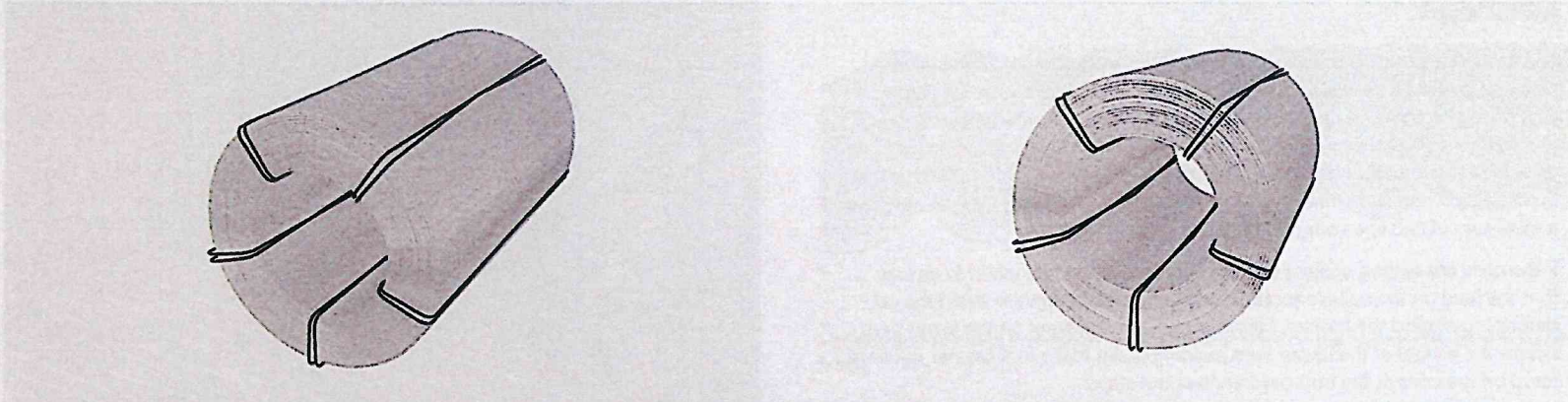
Wire Rod in Coils (WRIC)

Partially protected WRIC secured with four strapping bands

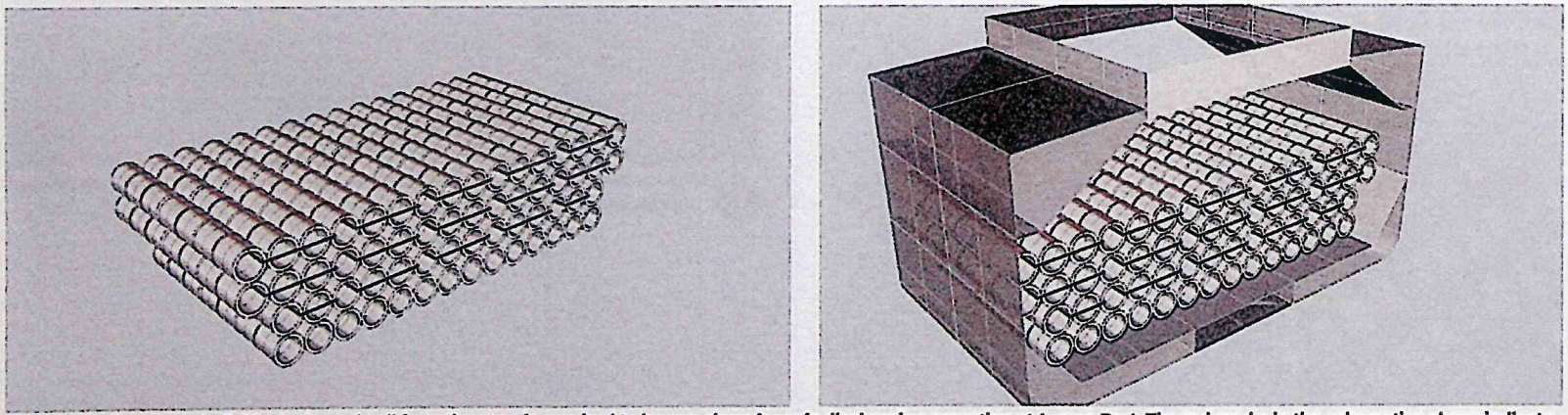


The outer canvas/plastic cover offers some protection from the elements

Wire Rod in Coils (WRIC)



Unprotected WRIC should be bundled with five bundling wire rods of minimum 6 mm size. Each bundling wire should be doubled



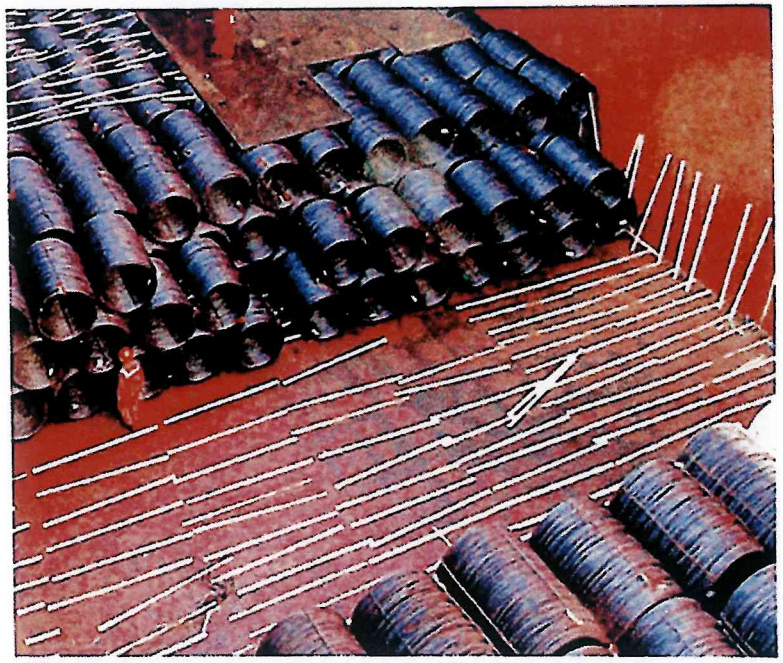
Prior to loading, each individual wire rod coil from the stow is required to be pre-slung for safe discharging operation at Jurong Port. The red marks in the schematics above indicate the slings and the black marks indicate the lashing of the coils

Wire Rod in Coils (WRIC)

Dunnage

The lower tier of WRIC on the tank-top or 'tween deck should be stowed on plywood dunnage sheets to prevent steel-to-steel contact with the ship's structure. The plywood dunnage should have a thickness of approximately 10 mm. The plywood should fully cover the tank-top. Timber dunnage or plywood sheets should be used on hoppers and 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 should be used.

If the coils are resting against side frames, care should 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.



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

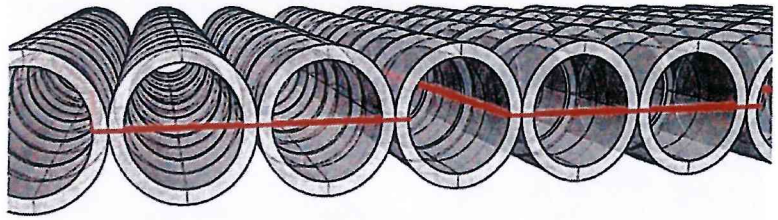
Wire Rod in Coils (WRIC)

Lashings

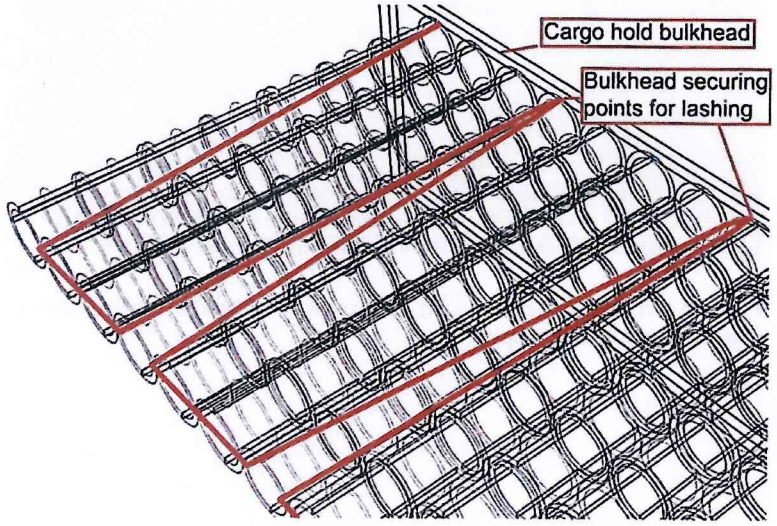
If the cargo is stowed homogeneously throughout the full width and length of the cargo hold, no lashing will usually be necessary. If the cargo only fills part of the hold and has an open face, the coils in the upper tiers will need to be secured.

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

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



Lashing and securing arrangement of one tier of WRIC to the bulkhead (a view from the front)



Lashing and securing arrangement of one tier of WRIC (a view from the top showing the securing points on the bulkhead)

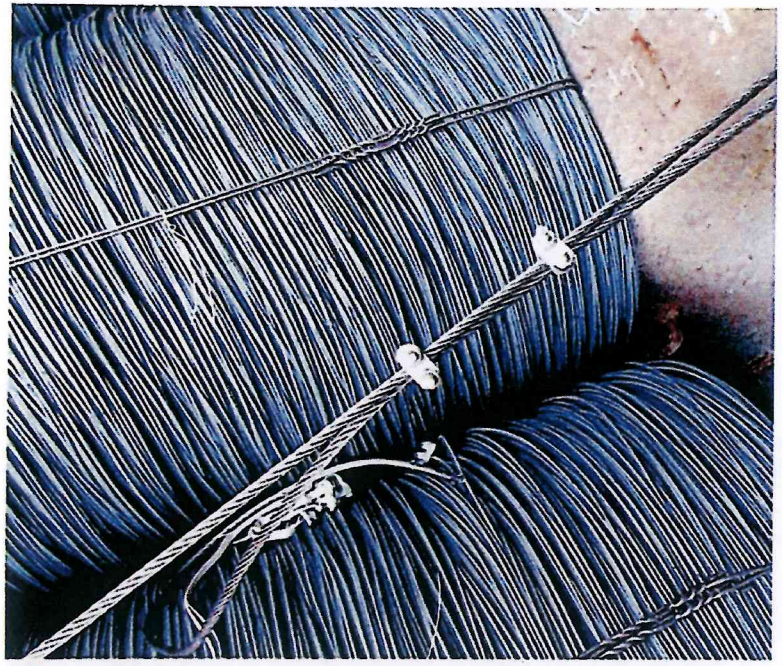
Wire Rod in Coils (WRIC)

The tiers of the stow have been lashed back with wires to the after bulkhead. The number of tiers must meet the manufacturer's recommendations

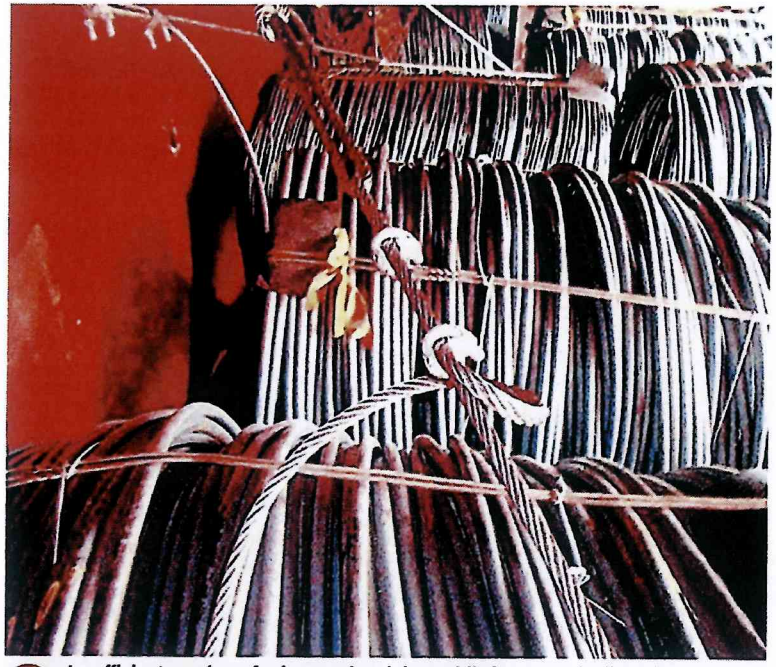
The WRIC tiers in the 'tween deck are lashed with steel bands. Steel bands are not elastic and cannot be secured to the vessel's bulkheads, so wire lashings should be used instead

For ease of handling, 16 mm (6 × 12) wire rope is considered suitable for lashing. The upper tiers should be secured by wires and the lower tiers may be looped together using nylon strapping.

Wire Rod in Coils (WRIC)



Insufficient number of grips used and the saddle is not on the live wire



Insufficient number of grips used and the saddle is not on the live wire

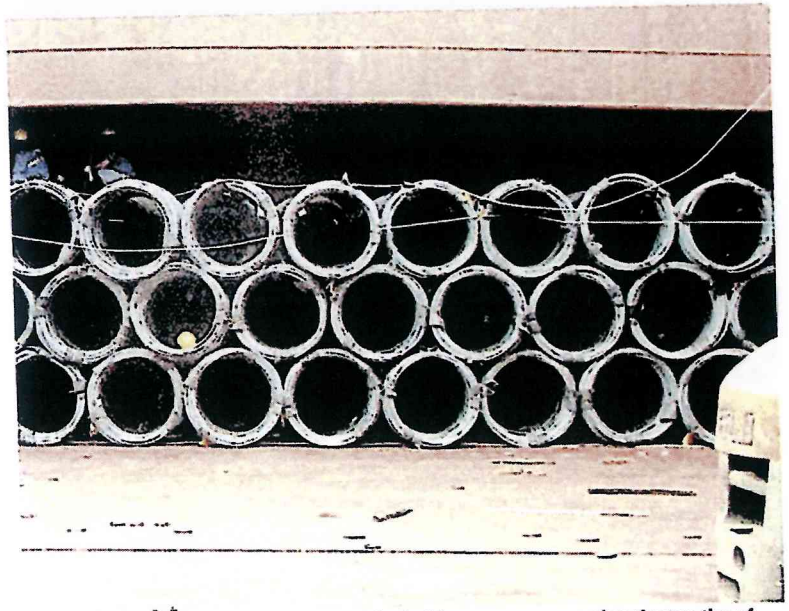
Stowage

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'*, WRIC should be stowed across the full width of the cargo hold and arranged so that the coils are tightly and compactly stowed.

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

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

If the coils are of different sizes, the largest coils should be stowed in the lower tiers. Slack coils should not be placed in the lower tiers.



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

Wire Rod in Coils (WRIC)

If necessary, more dunnage should be used to level the stow and/or fill in any gaps. Each lower-tier coil should 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 should be sought from the shipper/manufacturer of the coils if in doubt. Prior to the loading, confirmation should be sought and obtained, from the manufacturer, of the maximum allowable number of tiers in one stow. If such advice is not provided, the stow should not normally exceed ten tiers.

Wire coils may be stowed on top of other steel cargoes (plate, pipe, section, H-beam, etc.) but must not be over stowed by other cargo as WRIC can easily be deformed.

Tiers should, ideally, be staggered to avoid a vertical face and the face should 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.

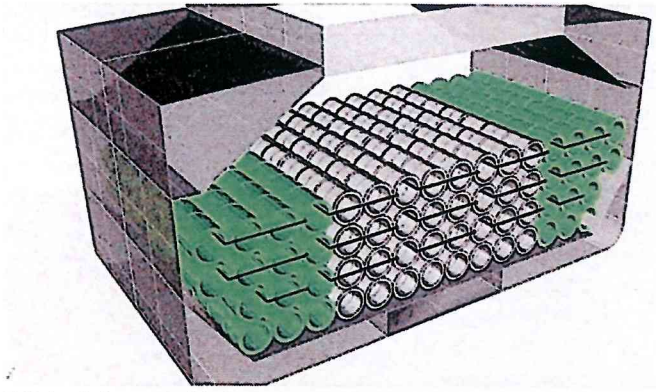
When the stow is not spread across the whole tank-top, but loaded with other cargoes, a high stow of WRIC is recommended to be loaded in the aft part of the hold to prevent a possible collapse in the event of excessive stern trim of the ship. When the cargo is part loaded in the hold, with a high vertical face, the coils at the forward edge of the stow should 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.

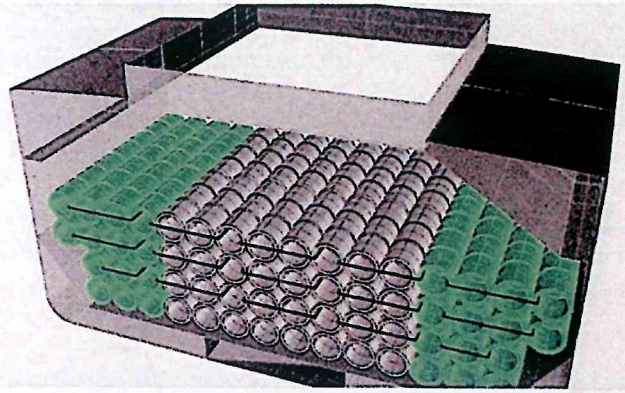
WRIC loaded on top of rebar, segregated with plastic sheets

Staggered and lashed upper tiers of WRIC

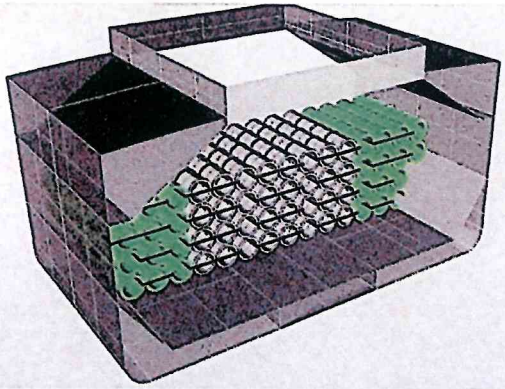
Wire Rod in Coils (WRIC)

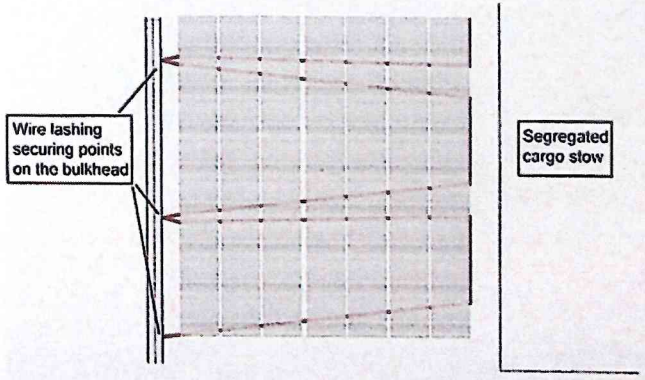
Correct Stowage and Lashing (pre-slinging is not indicated in these schematics)





Fully loaded cargo hold. The under-coaming coils should be lashed separately from the open hatch cargo stow. Lashing of WRIC 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 WRIC should be lashed in a group. The lashing wires should 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)

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 WRIC should not be accepted for loading

Unprotected coils brought to the ship by trailer. Only four single wire rod bundles have been applied

Covered coils brought to the ship for loading