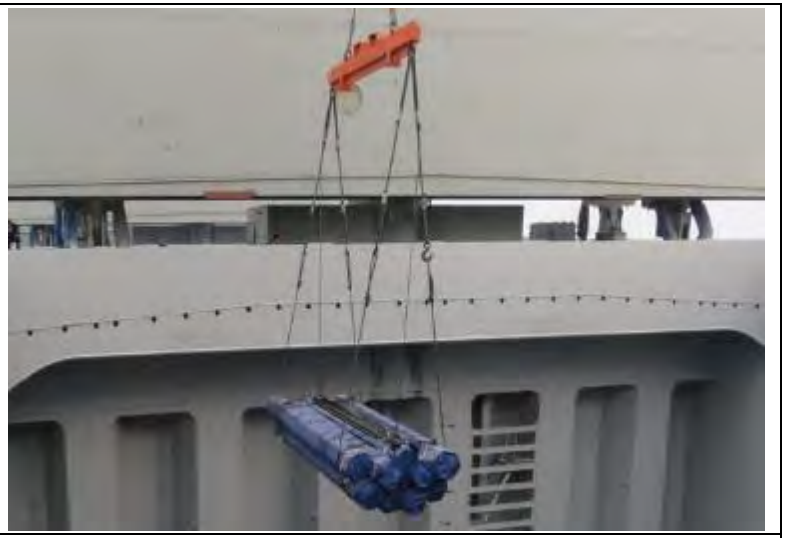
STEEL PIPES

Pipes being loaded over the ship's rail, using a single wire-leg basket lift under a spreader. Using wires in this manner could damage the surface coating of the pipe.



Bundled pre-slung pipes being loaded by basket lift. Note: the use of wire slings will damage the packaging and the pipes. Nylon slings shall be used for the basket lift.

Loose and badly secured pipe bundles.

Pipes strap-bundled into a hexagon shape, which makes a tight, efficient stow. The bundles, however, shall be pre-slung for tip-lifting at discharge.

STEEL PIPES

A forklift truck is used to push the pipes to the end of the hold. At the discharge port, the crane may not be able to be correctly plumbed; the pipes will swing when lifted.

It would be more appropriate and ultimately safer to stow alternative cargo under the overhanging 'tween deck before loading the pipes.

The tank-top space being used efficiently – shorter pipes are stowed in the narrower tank-top area, with the longer pipes in the open hatch area.

Pipes stowed evenly and tightly across the width of the hold, with timber dunnage used against the port and starboard bulkheads.

STEEL PIPES

Dunnage laid on the tank-top and against the bulkhead in preparation for the second row of pipes. Chocks have been used between the pipes for protection.

Stows being built up in a safe and efficient manner. Steel plates were laid across the pipes to protect them and to spread the load of the backhoe.

Wooden wedges used to secure the pipes horizontally.

Dunnage structure in progress for the hopper area and the first tier of pipes. The structure shall be continued vertically for the next tiers of pipes.

STEEL PIPES

This dunnage is likely to slide if left as it is, shall there be any movement of the pipe.

More substantial chocking against the bulkhead; each element is nailed. More dunnage is added between subsequent layers of pipes.

Loading in a box-shape cargo hold. The web lashing was laid on the tank-top and is prepared for the final securing of the stow.

Bundles stowed on dunnage, with timber used as protection around one edge, but not all. Wires can damage these small-bore pipes.

STEEL PIPES

Protection material used shall be suitable. Rags will wear through quickly by wire lashings.

Web lashings being rigged across bare steel pipes. Dunnage used correctly between the upper tier and the bulkhead.

Web lashings used across the upper layer of coated pipes.

Incorrect application of the wire lashing. The wire lashing is not tight, and it will cut the sling.

STEEL PIPES

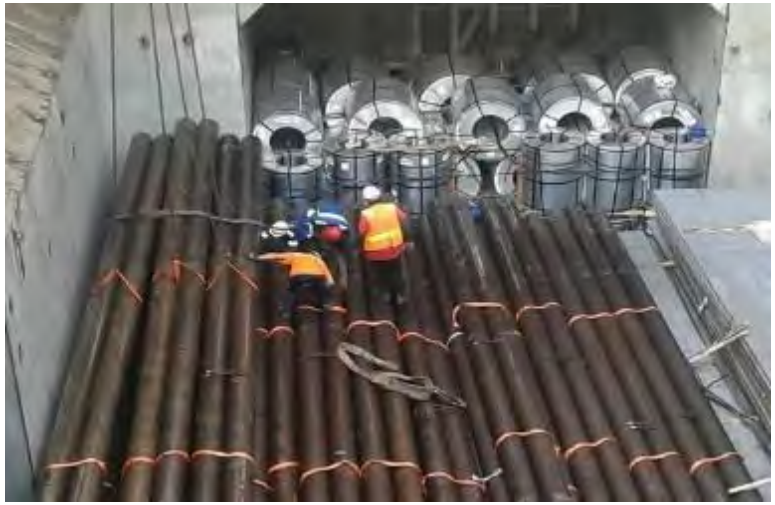
Ineffective wire lashings; the bundles appear to have spread out, damaging an adjacent wood crate.

Stanchions were fabricated to permit partial block stowage on the tank-top, adjacent to other cargoes.

Pre-slung bundles lashed into a “pen” created by fabricated stanchions. Lengths of timber shall have been used to protect the pipes from the steel wire used.

All lashings shall be tight and well made, with provision for adjustment of the turnbuckle during the passage.

STEEL PIPES



Pipe bundles being tipped by sorting hooks at Jurong Port, while the nylon lifting slings are positioned underneath. The pipes are pre-slung for tipping.

A loose stow of mixed size and bundled pipe, making discharge difficult, dangerous and slow. For mixed size pipes, pre-slinging is required.

Pipe being discharged by pipe hook.

A loose stow of mixed size and bundled pipe, making discharge difficult, dangerous and slow.

STEEL PIPES

Pre-slung pipes. The stevedores use tipping hooks to prepare the single basket lift for off-loading.

Swaged pipes loaded in an athwartships and longitudinal stow. Note that rope grommets are used at both ends to protect the swage. No dunnage was used.

Stow of various bundled and single pipes. The stow is not level. No dunnage is used. Pre-slinging with nylon web slings is required for such stow.

Lashed stow of various diameter pipes. Wires used for lashing. Note the dunnage between the tiers.

STEEL PIPES

Off-loading pipes with a single basket sling and placing the pipes on the quay.

Then, the pipes are handled with a forklift truck…

The pipes off-loaded with hooks to barges. The pipes shall be pre-slung.

The pipes off-loaded with hooks to barges. The pipes shall be pre-slung.

STEEL PIPES

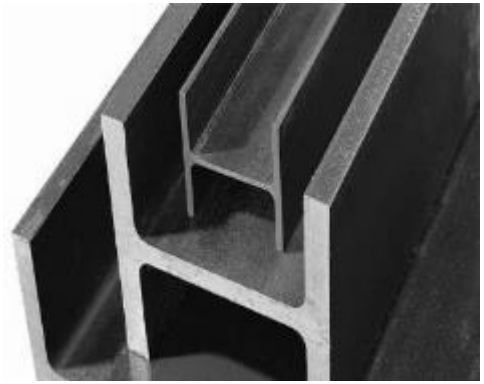
SUMMARY CHECKLIST

- Where possible, the pipes for loading shall be of the same size and length in a stow.
- Tank-top load limits are not to be exceeded. Consideration is to be given to the hopper areas, where the load limits may be smaller. Maximum tier heights are dependent upon the type/size of pipes. If in doubt, seek clarification from the shipper.
- Tank-top is to be prepared with appropriate hardwood dunnage to prevent steel-to-steel contact and to increase friction. Lashings are to be positioned athwartships and ready on the tank-top.
- Maximum distance between layers of timber dunnage on the tank-top typically shall not exceed 3 metres. The first and last row of dunnage shall be approximately 1 metre from the end of the pipes.
- Dunnage to be softwood boards with typical cross-section 150mm x 25mm.
- Dunnage to be used in way of bulkheads and other structures. For large diameter pipes, wedges are to be nailed to the underlying dunnage boards on the tank-top and fitted to both sides of each pipe to prevent them rolling.
- When loading small-diameter pipes in bundles, dunnage shall be used between the cargo tiers. Alternatively, the bundles shall be pre-slung.
- When loading large-diameter pipes, dunnage between tiers may not be necessary. Vertical dunnage between the last layer pipes shall be considered. Dunnage stool may be required to be built between the stow and the side bulkheads of the hold.
- For a stow of mixed diameter pipes, pre-slinging of the pipes is required. Dunnage between tiers shall also be considered.
- All tiers to be stowed predominantly in fore-and-aft direction and level.
- In the cargo compartments, where possible, safe passage shall be provided directly from the Australian ladders to the top of the cargo stow. Safe access shall also be provided from the tank-top to the top of the cargo stow.
- DO NOT mix the lashing arrangement; choose one and stick with it.

STRUCTURAL STEEL

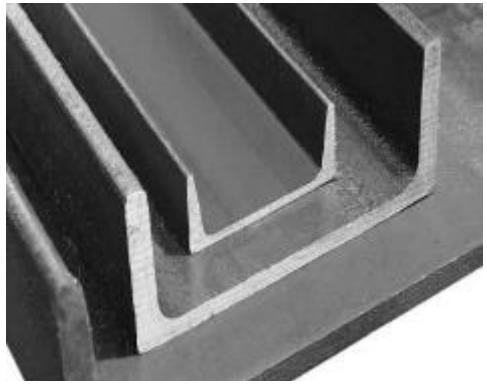
GENERAL

Structural steel is a generic term for manufactured, shaped steel and includes beams, flats, rails, channels, angles, rounds, half rounds, squares, profiles and others used in the construction industries, amongst others. The cargo is generally shipped in unprotected bundles secured by lengths of steel band or thin wire rods wrapped around the bundles at intervals. These bands or wire rods hold no strength and shall not be used for lifting. The number of units per bundle will vary with their size and shape within the bundle. Bundles are typically 6 and 12 metres in length; however, longer units of 18 metres may also be transported. The weight of a bundle will vary.



Beams

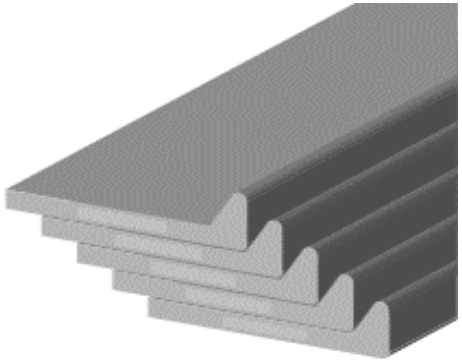
Flats



Channels

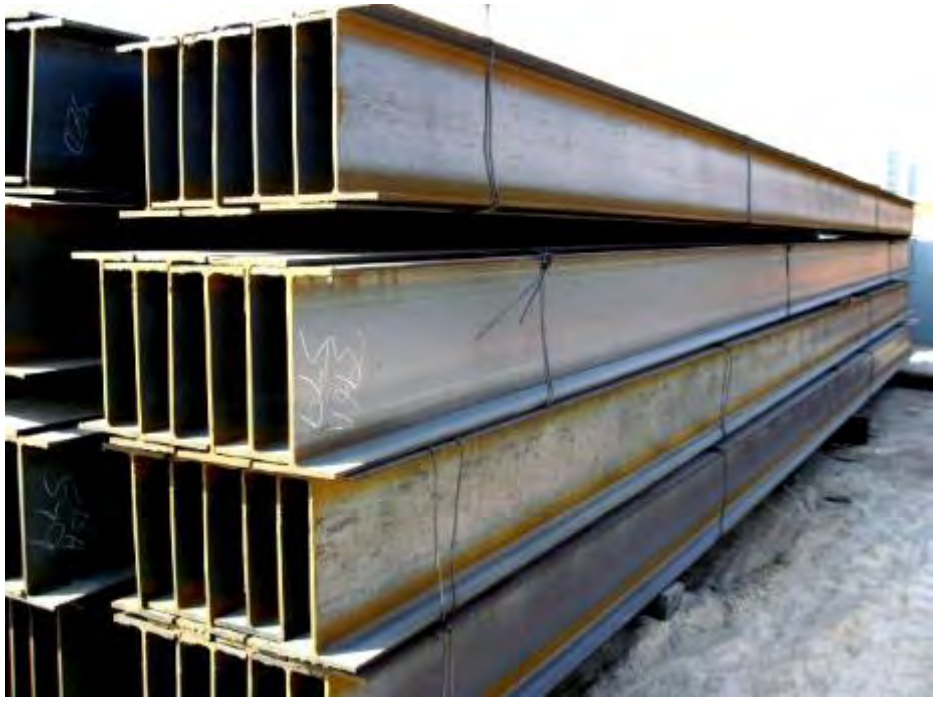
Angles

Rounds and squares



Bulbs

STRUCTURAL STEEL



Units in open storage prior to shipment, showing signs of corrosion.

Wire strapping angles along the length of the bundles are not designed for lifting.

BUNDLING

Some units are bundled, whilst others are not. Usually, wire rod is used for bundling purposes. The wire rod shall be of 6mm size. Each bundle shall be double and spaced, depending on the length of the structural steel, at intervals of approximately 2 to 3 metres, and at 0.5 metres from the ends. The two ends of the wire bands 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 forklift trucks.

STRUCTURAL STEEL

DUNNAGE

Steel cargoes tend to shift if not correctly dunnaged as there is very little friction between steel products laid directly atop each other.

In accordance with industry good practice[7], robust, good, dry, bark-free, hardwood dunnage shall be used throughout as softwood dunnage is too easily crushed or damaged.

Timber dunnage shall be laid athwartships on the tank-top prior to loading. Dunnage shall be spaced at intervals of not more than 3 metres. 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. The first and last dunnage row shall be placed at approximately 1 meter from the end of the units, to allow for passing of the slings underneath.

75mm x 75mm of robust hardwood dunnage shall be placed on the tank-top. Structural steel shall be stowed in level tiers, with dunnage between each tier. Robust hardwood dunnage of size 60mm x 60mm shall be used between the first 6 tiers. For the subsequent tiers, softwood dunnage of the same size may be considered. The dunnage between tiers shall be aligned vertically.

Any nylon belts used for pre-slinging shall be clearly and permanently labelled with the SWL of the sling.

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

STRUCTURAL STEEL

Good, robust, dry, hardwood shall be used when loading structural steel.

Generally, 75mm x 75mm of square cross-section is preferred on the tank-top, and 60mm x 60mm through the stow.

STRUCTURAL STEEL

LASHINGS

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

When the cargo is stowed in the fore-and-aft direction across the full width of the cargo hold, the stow is prevented from shifting by the friction resistance of the timber dunnage and the confines of the cargo space. Wire lashings 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 of the 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 3 per 12-metre length of bundle would be considered reasonable. The upper tier or tiers shall be properly secured by the use of dunnage and wedges prior to the lashing.

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.

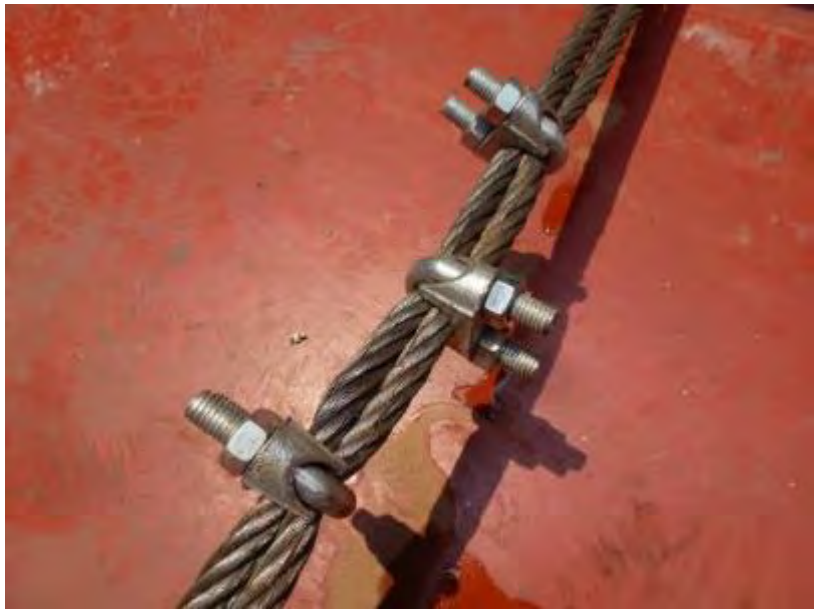
STRUCTURAL STEEL

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 saddle shall be on the live (load bearing) wire. The wires shall be tightened by 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 on the basis of the size of the wires:

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

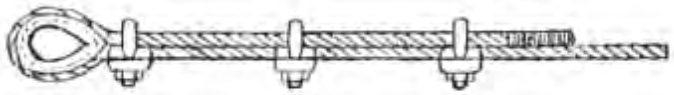
The bolts should be tightened sufficiently to compress the wire to $^2/_3$ of its nominal diameter. For the purpose of lashing structural steel loaded throughout the full width of a cargo hold, 3 bulldog grips are considered to be sufficient for a 16mm wire. For a stow of structural steel not covering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



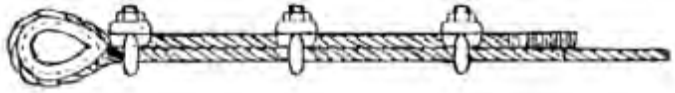
Incorrect way of using bulldog grips.

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

STRUCTURAL STEEL



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.

STRUCTURAL STEEL

STOWAGE

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

The cargo units are normally handled with the use of chains or wire slings.

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 underdeck stiffening, it is prudent to allow a safety margin.

It is normal practice to stow bundles of structural steel 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 under the coamings. The stow shall form a solid block within the cargo space.

It is not uncommon for alternate layers of structural steel to be stowed athwartships, but care shall be taken to ensure that the cross layer is of identical size and type and that there is no steel-to-steel contact with the ship's structures. The ends of athwartship units shall not be in direct contact with the ship's shell plating or bulkheads.

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.

For two horizontally separated stows, the clearance between the stows, where possible, shall not be less than 1 meter.

A good, even stow of structural steel bundles with dunnage between the tiers to assist the discharge operation.

STRUCTURAL STEEL

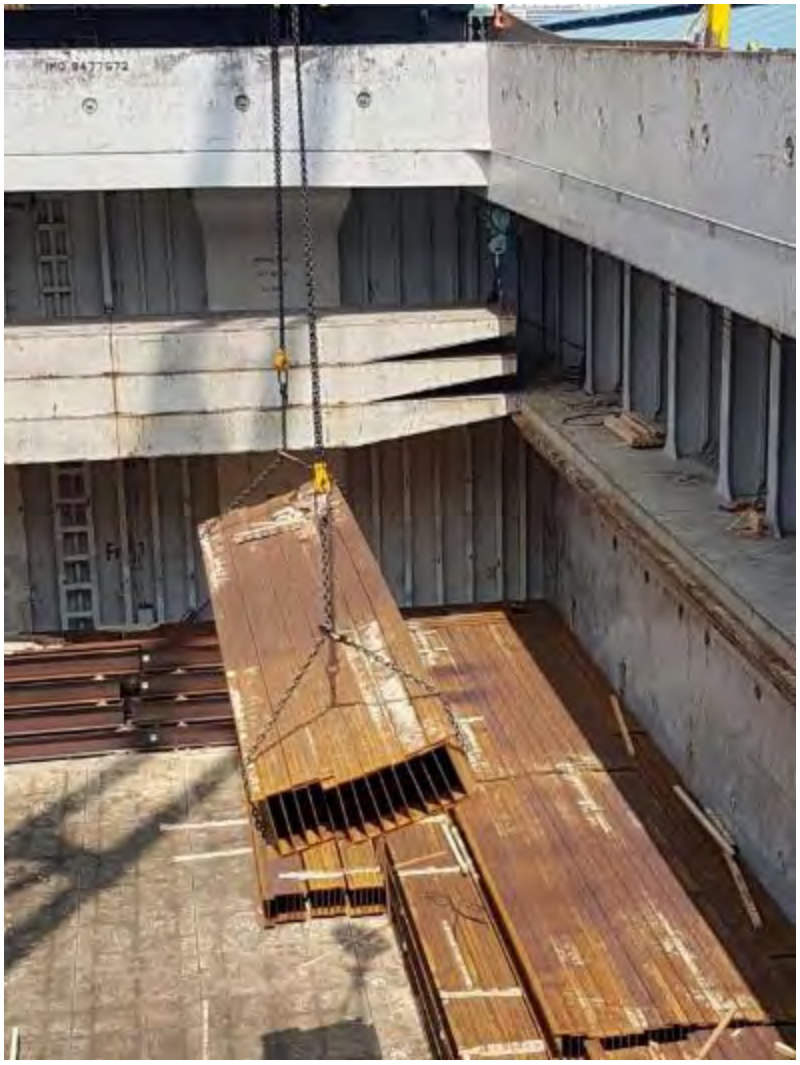
Ports typically uses two chains, each of 10-tonne SWL with a “choke hitch”. In this manner, they can handle six or seven bundles per lift of a maximum cumulative weight of approximately 14 tonnes.

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

For the handling of sheet piling, braided slings are used as the edges are susceptible to damage.

Beam clamps and ‘C’ hooks are also used for off-loading of single units of structural steel.

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



STRUCTURAL STEEL

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-coamings to the open hatch square. This is made for preventing human injury and to minimise cargo damage. To facilitate the off-loading of such cargo, forklift trucks are utilised.

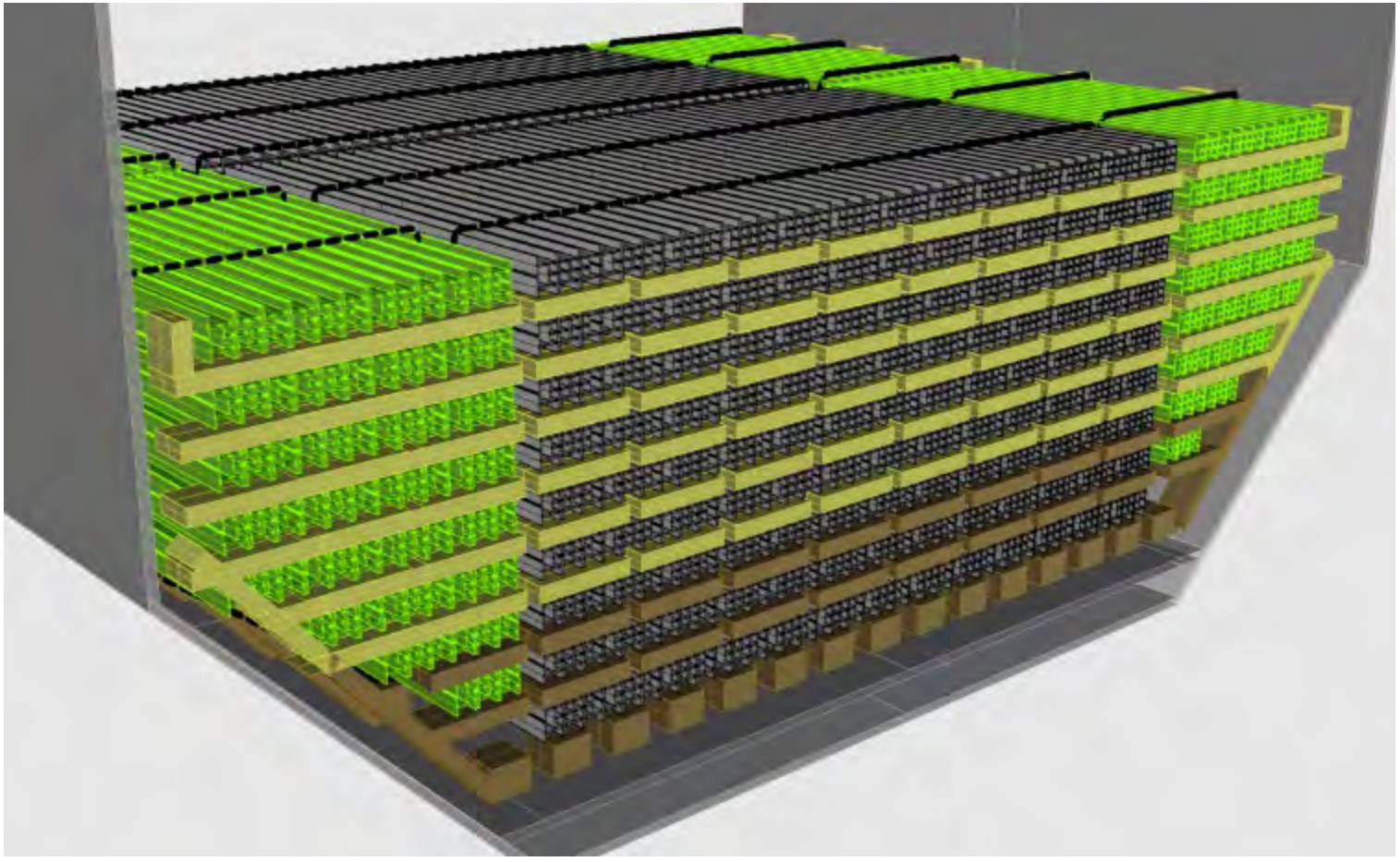
This requires that the bundles stowed under the wings of a hopper-type cargo hold or under the coamings of a box-type cargo hold are stable and well dunnaged between each tier. If an athwartships stow is considered, the length of the units shall be identical to the width of the cargo hold.

Units stowed under the wings by a forklift truck, prior to loading in the hatch square. Dunnage and lashing wires must be pre-laid on the tank-top, and additional dunnage between the subsequent tiers.

STRUCTURAL STEEL

SCHEMATICS FOR CORRECT STOWAGE, LASHING AND DUNNAGING

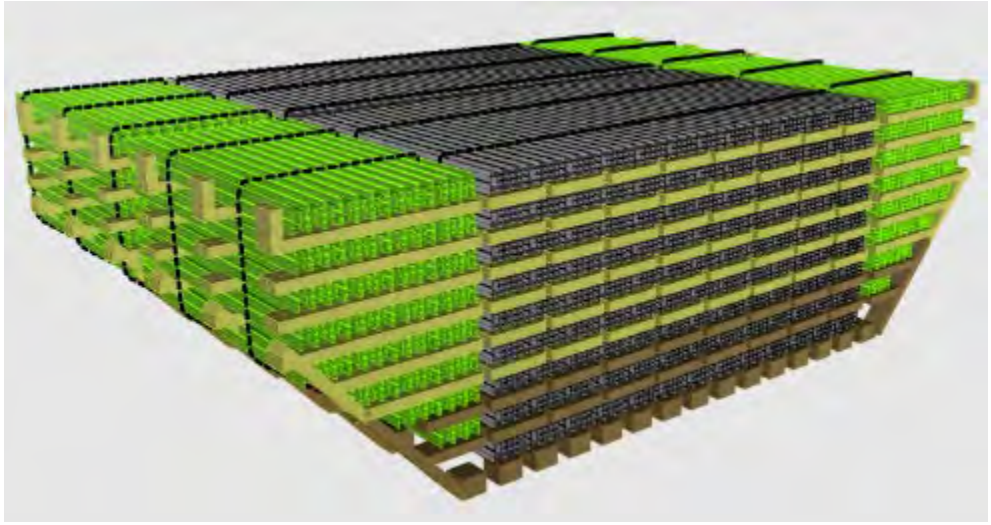
All schematics are indicative.
Structural steel units. the under-coaming cargo is lashed separately.



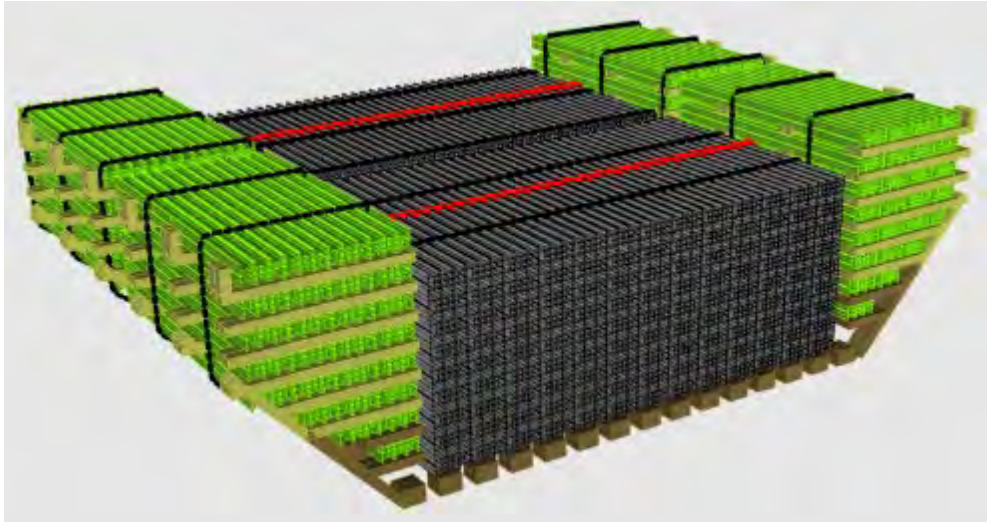
	Under-coaming stow
	Open hatch stow
	Soft wood dunnage
	Hardwood dunnage

STRUCTURAL STEEL

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

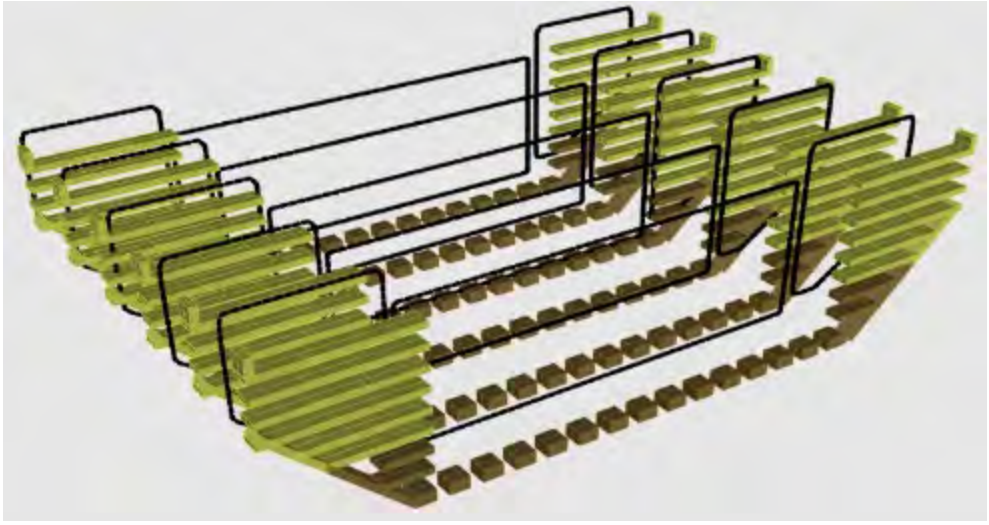


The under-coaming stow is lashed separately to prevent collapse of the stow during off-loading.



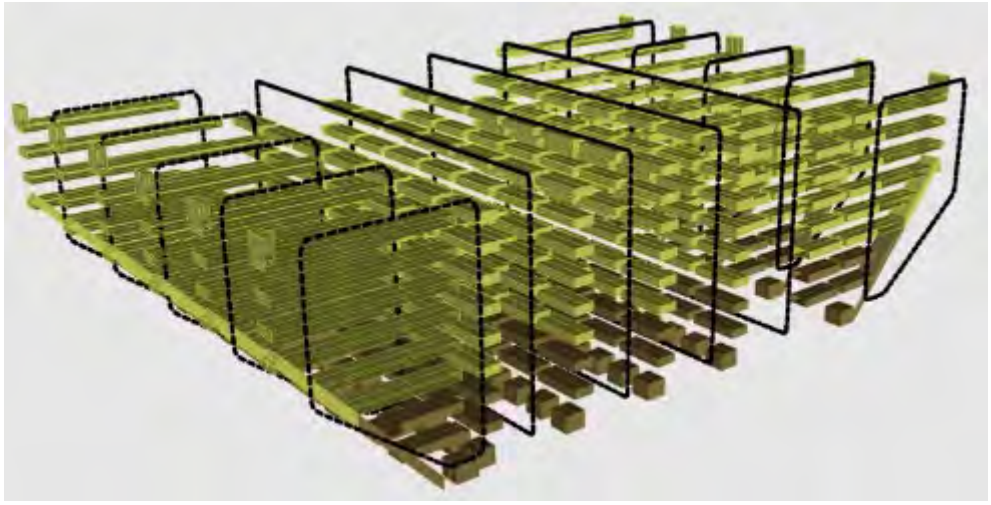
The pre-slung stow (red colour) under the open hatch is lashed separately. It does not require dunnage except for the first tier to avoid contact with the tank top.

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

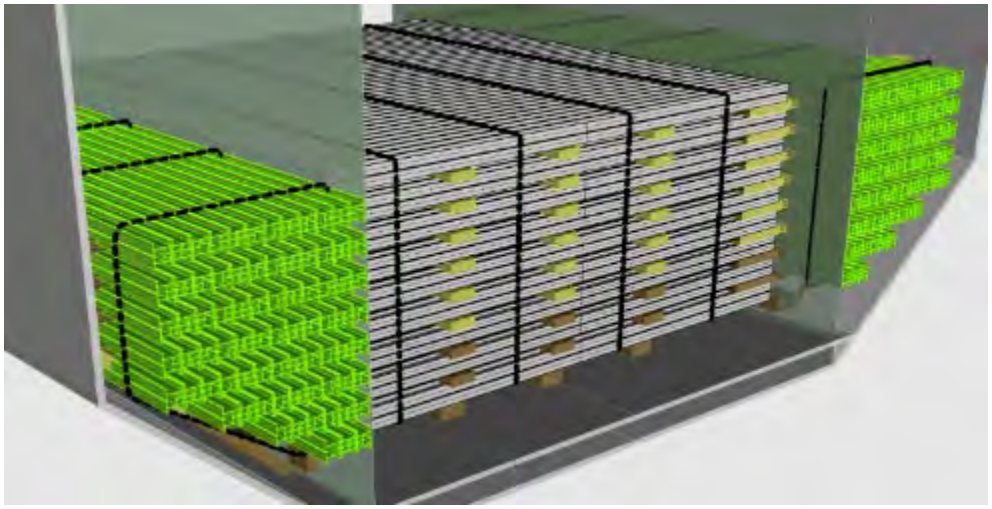


Dunnage and lashing schematics for a longitudinal stow of structural steel. If the stow under the open hatch is pre-slung, dunnage may not be used for this part of the stow.

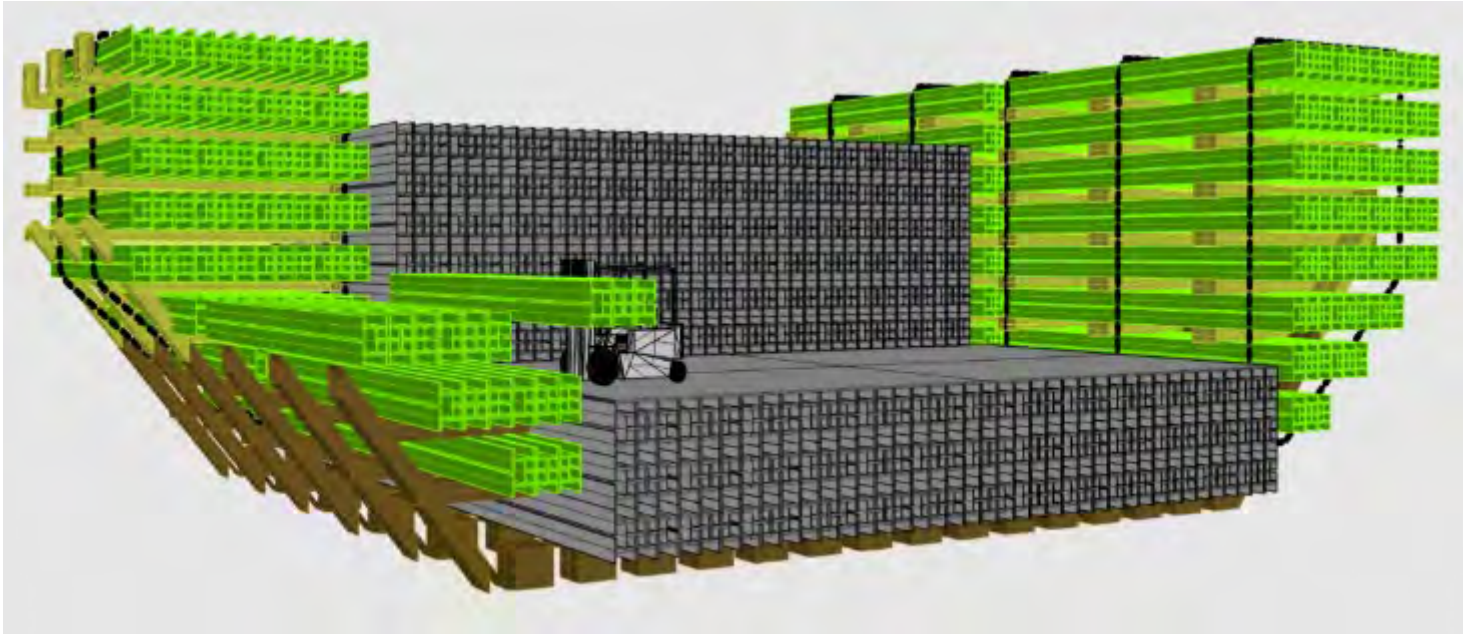
STRUCTURAL STEEL



Dunnage and lashing schematics for an athwartships stow of structural steel under the open hatch area.



The stow in under the open hatch area is stowed in an athwartships direction. Dunnage and lashing is used for all stows.



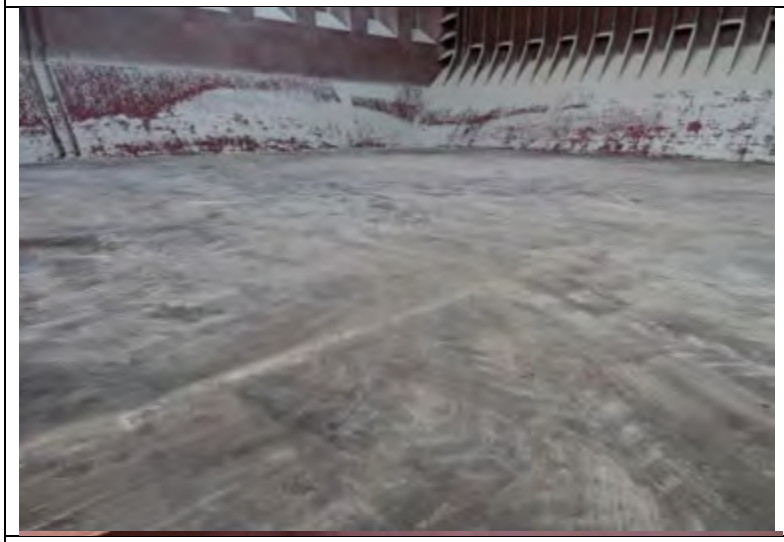
Handling of under-coaming stows with a forklift truck. The stow under the open hatch may need to be loaded/discharged together with the under-coaming stows. Steel plates shall be used for the forklift truck for maneuvering. The under-coaming stow lashing is independent to prevent collapsing of the stow.

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

STRUCTURAL STEEL

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. The residue from some bulk cargoes can react with, and damage, the steel cargo.

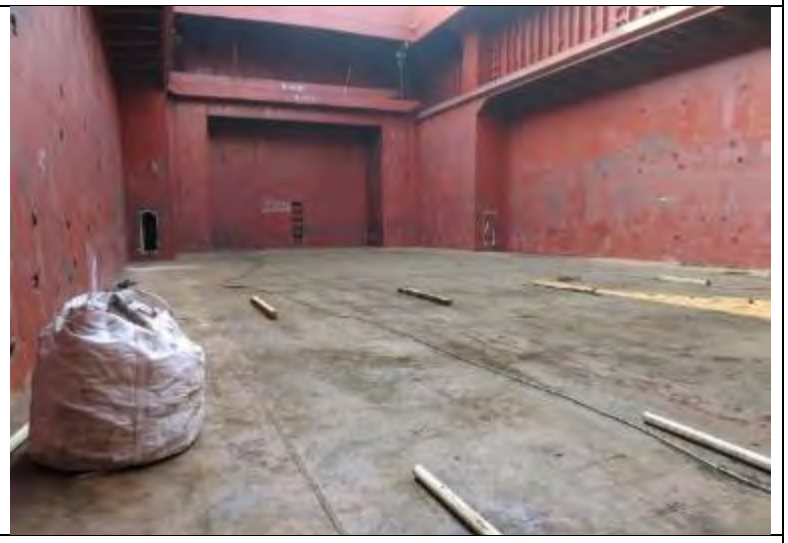
Poorly prepared cargo hold on a cargo ship. Again, the cargo residues may react with, and damage, the steel cargo.

STRUCTURAL STEEL

Units are often left in open yard storage where they will be potentially wetted with subsequent corrosion. Many receivers will not accept extensively corroded units.

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

Bundled units about to be loaded.



The tank-top is prepared prior to loading, having been cleared of debris. Dunnage and lashing wires have been pre-laid.

STRUCTURAL STEEL

Units are sometimes stowed athwartships due to the constraints of the space available for loading.

Units stowed athwartships forward of the hatch square require a forklift truck for them to be discharged.

Units shall not be fanned out in way of the hopper tanks, but sufficient dunnage is placed on the hopper plating to prevent steel-on-steel contact.

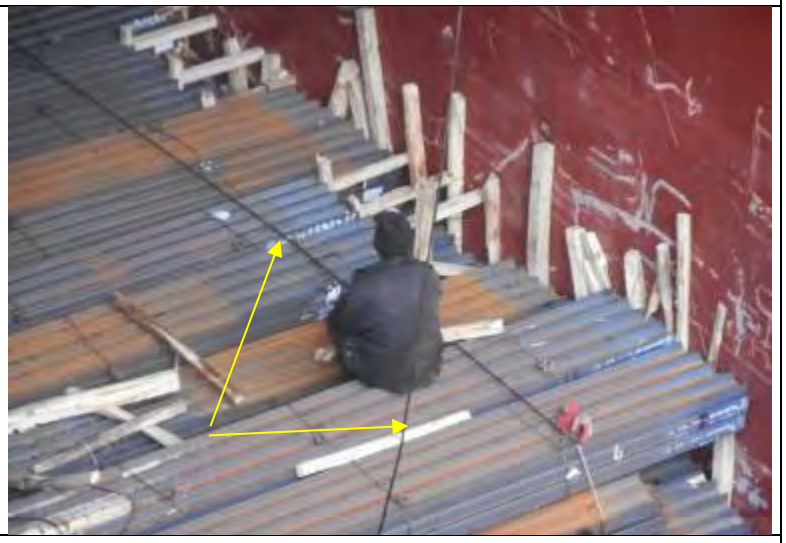
60mm x 60mm section dunnage being laid between layers of structural steel. The dunnage shall be of hardwood for the first 6 tiers.

STRUCTURAL STEEL

The dunnage on the bulkheads shall be placed prior to positioning of the structural steel to prevent damage to the coating and bulkhead.

Missing dunnage on the side bulkhead of the stow.

The longer structural steel units shall be stowed under the shorter units.

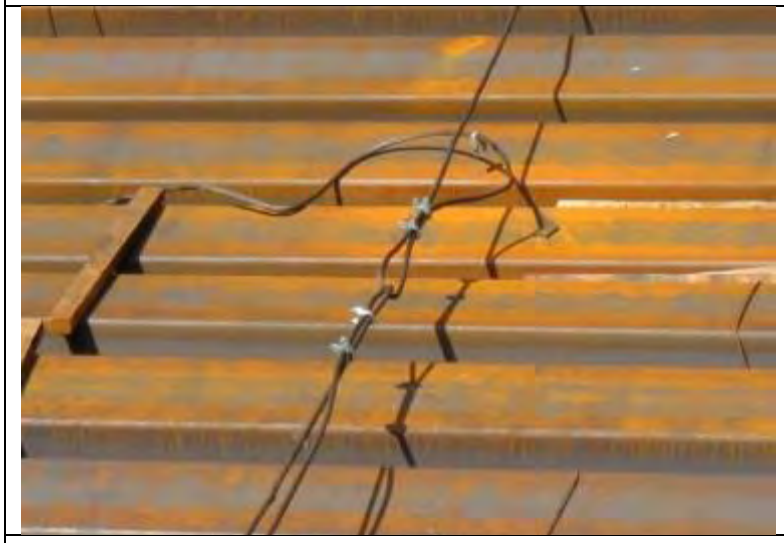


Lashings being tensioned on the completed stow.

STRUCTURAL STEEL

Incorrect securing method for a wire lashing.

Tiers of various structural steel evenly layered and correctly stowed to form a block stow in a hopper-type cargo hold. Dunnage well placed between tiers.

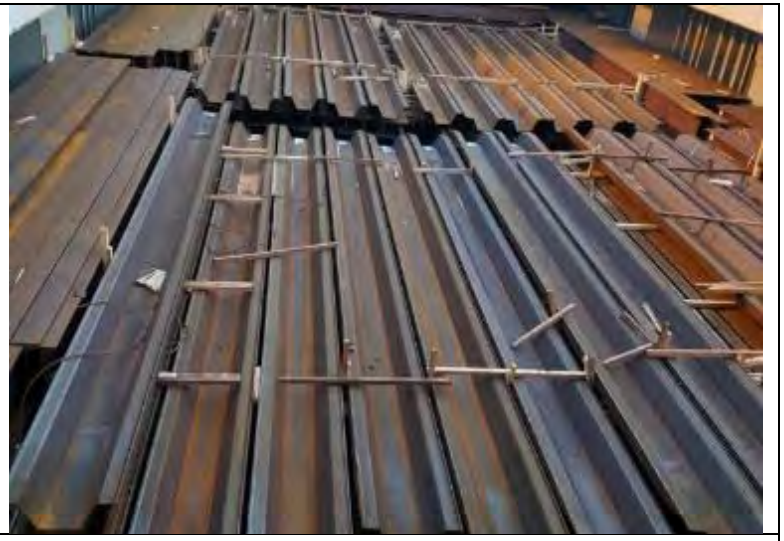


As a minimum, three wire clips shall always be used at each wire end. The arrangement shown does not provide a means for tensioning the lashing.

Upon arrival at a port, units with well-positioned dunnage ease the discharge operation and allow for easy slinging and handling of the bundles.

STRUCTURAL STEEL

Good stow with the shorter beams on top of the longer ones. Dunnage is used between tiers.



Good level stows with vertical dunnage wedges.

Good use of dunnage. Stows in longitudinal and athwartships directions. However, the lower stow is covered with longitudinally oriented beams.

Good stows in longitudinal and athwartships directions. The lower stow is covered with longer longitudinally oriented beams.

STRUCTURAL STEEL

An athwartships stow of beams. The length is identical to the width of the hold. No dunnage is used for the bulkheads. This may cause damage to ship and cargo.

Under-coaming stow in an athwartships direction.

Well-secured and dunnaged upper tier of structural steel products.

Use of beam clamps for off-loading.

STRUCTURAL STEEL

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

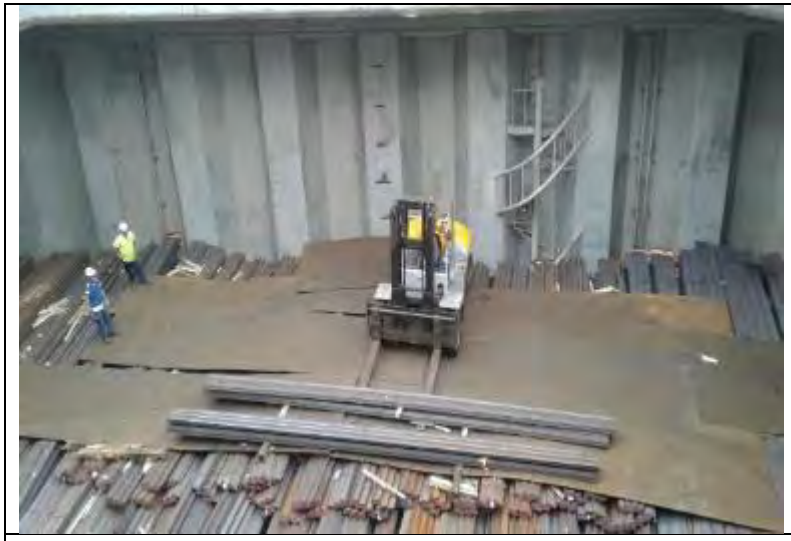
The longer units shall be loaded under the shorter units.

Tip-lifting causes excessive operational delay.

Tight block stow requires the first lift to be assisted by tip-lifting to pass the chain sling. It is recommended that the first bundle is pre-slung.

Where the bundles are strong and tight, the off-loading can be carried out by the use of beam clamps placed at both ends of the units.

STRUCTURAL STEEL



Forklift trucks are used to assist with the wing access and slinging of the bundles.

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

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

Once off-loaded, the structural steel units can be handled by side-loading forklift truck. For example, such side-loading forklifts are used by Jurong Port

Once off-loaded, the structural steel units can be handled by conventional forklift truck.

STRUCTURAL STEEL

SUMMARY CHECKLIST

- Tank-top load limits are not to be exceeded. Consideration is to be given to the hopper areas, where the load limits may be smaller.
- The loading of structural steel is normally in the fore-and-aft direction. Sheet piling and some units allow for loading in an athwartships direction.
- The cargo units shall not be in direct contact with the vessel's shell plating, bulkheads and tank-top.
- The tank-top is to be prepared with appropriate dunnage to prevent steel-to-steel contact. Lashing wires are to be pre-positioned on the tank-top. Dunnage on the tank-top is to be robust hardwood with a minimum cross-section of 75mm x 75mm.
- The maximum distance between rows of timber dunnage is not to exceed 3 metres. The first and last rows of dunnage shall be positioned approximately 1 meter from the ends of the cargo units.
- Dunnage between tiers is to be laid to assist with slinging. 60mm x 60mm dunnage may be used between the layers, with robust hardwood dunnage between the first 6 tiers and softwood dunnage for the subsequent tiers.
- All tiers to be stowed level. The face of the stow is to be as straight as possible, with sufficient clearance from the adjacent stow to prevent virtual over stows. Longer units are to be stowed under shorter units.
- When the stow is complete, a sufficient number of wire lashings are to be used for the securing of the whole block of cargo units.
- Where possible in the cargo compartments, safe access 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.

HOT AND COLD ROLLED STEEL COILS

GENERAL

Coils are generally of two types – hot rolled coils (HRC) and cold rolled coils (CRC). The HRCs are unfinished products without packing, which will be further processed. The CRCs are finished products ready for direct use when uncoiled. The CRCs are shipped fully wrapped, packed and protected to avoid damage by handling and moisture ingress. Both types of coils are normally secured by metal strapping bands. The coils are secured by several straps (usually four for the HRCs and usually five to six for the CRCs), which are transversely passed through the core. In addition to the transverse straps, coils are also secured by circumferential straps of not less than three for both types of coils. These strapping bands are not designed for lifting and shall not be used for this purpose. Coils presented for loading with broken, loose or missing metal straps shall not be accepted.

Coils come in various sizes and grades. The weight varies and, generally, coils are more than 7 tonnes and may be up to 30 tonnes per unit. Coil sizes vary from between 1.50 metres and 2.00 metres in length with a maximum outside diameter of approximately 1.50 metres.

Hot Rolled Steel Coils with insufficient metal straps shall not be accepted for loading.

Packaged Cold Rolled Steel Coil off-loaded with braided sling.

HOT AND COLD ROLLED STEEL COILS

DUNNAGE

The lower tier of coils on the tank-top or 'tween deck shall be stowed on bark-free dunnage (boards / timber planks). Similarly, timber dunnage shall be used on hoppers, in way of side frames or vertical bulkheads. It must be remembered that the dunnage used for the loading of coils cannot distribute the load of a coil over the tank-top, although it may assist to some extent. To distribute the load over the tank-top, timber wooden beams must be used. The selection of such beams and their size shall be in accordance with the cargo hold structural parameters of the individual vessel and the beam location in the cargo holds. Typical size of timber beams for load distribution is between 100mm x 100mm up to 200mm x 250mm.

When using timber planks, and regardless of the number of tiers, a minimum of two lines per row of coils shall be laid on the tank-top for coils of 7 to 15 tonnes in weight and a length of 1.5 metres. For single-tier coils of between 15 tonnes and up to 22 tonnes in weight and a length of between 1.5 and 2.00 metres, three lines shall be used. Where two tiers of coils are stowed, four wood planks shall be used. For heavier coils of up to 30 tonnes loaded in a single tier, four planks are to be used.

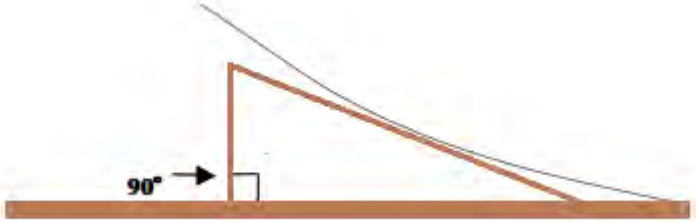
The cross-section of the planks shall be 150mm x 50mm (6" x 2"). The length may vary; however, it is usual for the wood to be approximately 1 to 1.5 metres in length. In any event, the length must cover the footprint of a coil on the tank-top and spread over at least two frames/longitudinal.

Dunnage boards and wood wedges prepared for the loading of steel coils.

HOT AND COLD ROLLED STEEL COILS

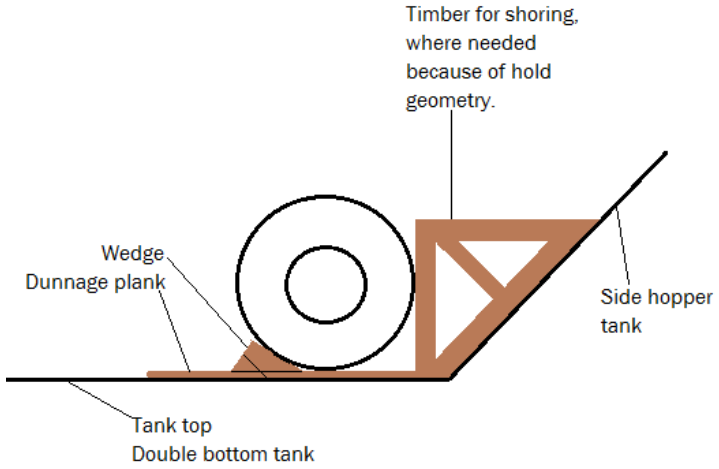
Each coil shall be resting against an outboard adjacent coil. Dunnage wedges shall be placed and nailed on the timber planks pointing to the ship's side to lock in the coils. The right angle of the wedge shall be on the top, as indicated on the schematics below. Where one coil from the first tier is locked with two second-tier coils on both sides, there shall be wedges on both sides of the first-tier coil.

Correct use of the wedge with the right angle on top.



Incorrect use of the wedge with the right angle on the plank.

If the coils rest against side frames, proper dunnage shall be used, and care shall be taken to ensure that the load on the coils is evenly spread along the length to avoid the coil deforming around the frames. This is particularly relevant on the lower tiers, where the weight from the upper tiers pushes the first-tier coils sideways. Timber shoring shall be considered for cargo holds with different geometry.



As a result of the geometry of the cargo compartments, dunnage for shoring shall be used at the ship's hopper side.

HOT AND COLD ROLLED STEEL COILS

LASHINGS

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

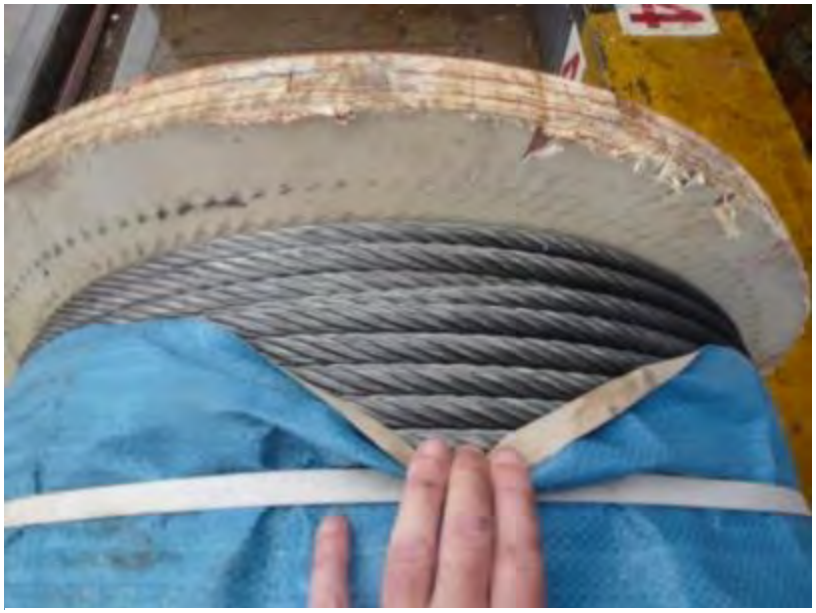
The objective of the lashing is to form one large immovable block of coils. The lashing of the coils is usually carried out with the use of steel strapping bands of size between 25mm and 40mm. The safe working load of these strappings is usually approximately 4 tonnes. Steel strapping bands shall always be tightened with pneumatic tools and never by hand. Consideration shall be given for the strapping of coils of weight above 15 tonnes to be doubled. The lashing of coils stowed in one, two and three tiers in a box-shaped cargo compartment, is shown below:

25mm steel strapping bands for securing coils.

Tightening of steel strapping bands with a pneumatic tool. For coils of the size in the photograph, double metal straps shall be used for lashing.

HOT AND COLD ROLLED STEEL COILS

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.

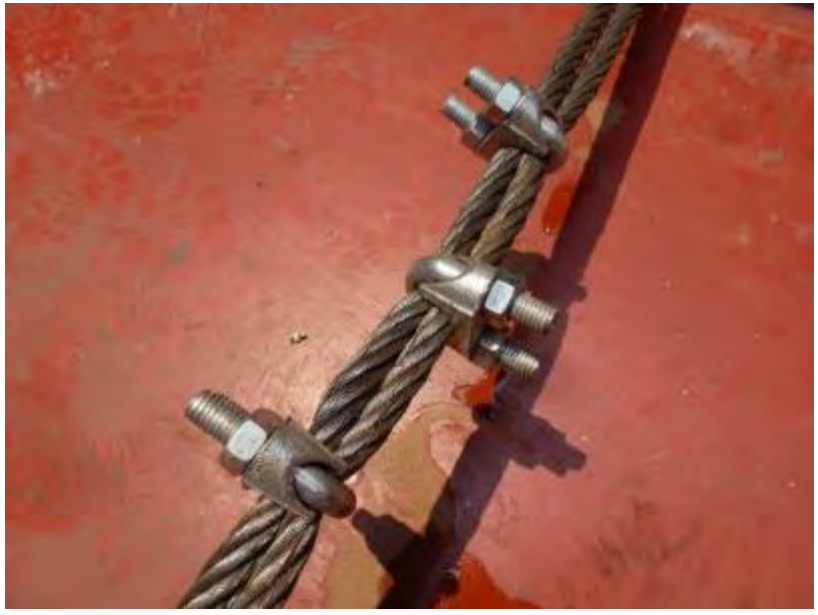
HOT AND COLD ROLLED STEEL COILS

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 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.

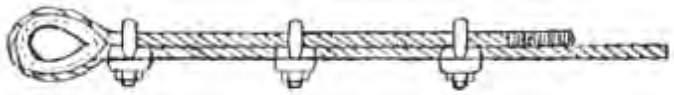
The bolts should be tightened sufficiently to compress the wire to $^2/_3$ of its nominal diameter. For lashing steel sheets in coils, 3 bulldog grips are considered to be sufficient for a 16mm wire.



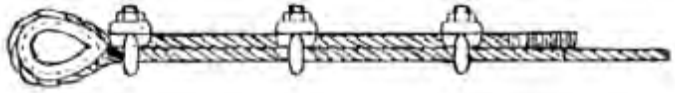
Incorrect way of using bulldog grips.

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

HOT AND COLD ROLLED STEEL COILS



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.

HOT AND COLD ROLLED STEEL COILS

STOWAGE

All cargo shall be stowed in accordance with the IMO Code of Safe Practice for Cargo Stowage and Securing (CSS Code) and vessel's own Cargo Securing Manual (CSM). Good guidelines are provided in the latest edition of the Thomas' Stowage.

Generally, with respect to the loading, stowage, securing and dunnaging of steel sheeting in coils, vessels' CSMs provide sufficient ship's specific details. Where this is not the case, instructions shall be sought from the Classification Society to avoid structural failures and overloading of the cargo compartments' tank-tops.

Coils are generally heavy units, and unlike the other types of steel cargoes, the steel coils produce concentrated point loading on the tank-top and do not present a homogeneous load. The maximum allowable tank-top loading may be, therefore, easily exceeded, resulting into structural damage. The steel coils are usually stowed with their axis in a fore-and-aft direction. An athwartships stow shall be avoided and is not recommended. According to the industry accepted publication, Thomas' Stowage[8], coils shall be stowed across the full width of the cargo hold and arranged so that the coils are tightly and compactly stowed. Coils may be also stowed with their axis in a vertical direction.

Compact, rigid blocks are vital to effect a good stow. With their low stowage factor, coils cannot be stowed on the 'tween deck but only on the tank-top in the cargo holds. The stowage shall be uniform and compactly arranged to avoid breakdown of the stow and subsequent crushing and/or disintegration of coils.

Single-tier coils without a locking coil shall be avoided, if possible. It is recommended that, where the tank-top strength is not exceeded, a locking coil is always placed.

Compact stow of CRCs in a hopper-type cargo hold.

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

HOT AND COLD ROLLED STEEL COILS

Coils shall be handled with care to prevent scoring, scratching, localised sharp bends and/or damage to the packing of the CRCs. Braided wire slings, nylon slings, clamps, tongs, 'C' hooks and magnets are normally used for this purpose. The handling of CRCs with braided wire slings requires the use of spreaders. Nylon web slings may be used without spreaders.

When forklift trucks are used to handle the coils, these are normally equipped with flat blades, poles, clamps, tongs or 'C' hooks.

Nylon web sling.

Braided wire sling.

If the coils are of different sizes, the largest and heavier coils shall be stowed in the first tier. Similarly, coils with failed or insufficient straps shall not be placed in the lower tiers. Ideally, such coils shall not be loaded without the problem being rectified. Each first-tier coil shall rest against another coil or the adjacent bulkhead.

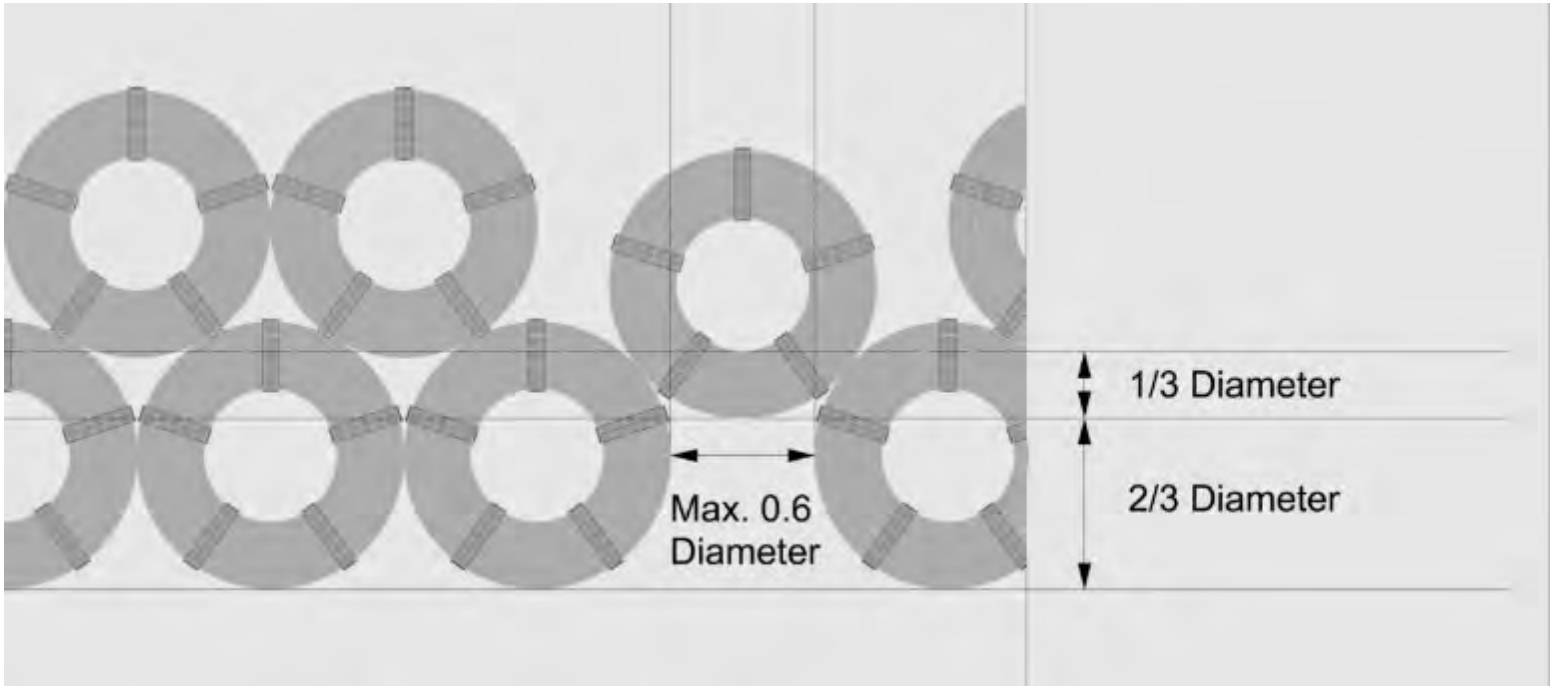
The maximum number of coil tiers is subject to the weight of the coils. For coils with a weight of 15 tonnes and more, the maximum number of tiers is usually two. Where the coils are lighter, the stow can comprise more tiers; however, the maximum tiers may not exceed three. For coils more than 25 tonnes, one-tier stowage shall only be considered. In any event, the maximum uniform loading of the tank-top shall never be exceeded.

Coils may not be stowed atop other steel cargoes (plates, pipes, sections, H-beams, etc.). However, it is not usual to store other steel cargoes atop coils, except for wire rods in coils.

When the stow is not spread across the whole tank-top area, but loaded together with other cargoes, a stow of coils may be loaded in any part of the hold. When more than one tier of coils is to be loaded in the foremost holds of a bulk carrier, and where the cargo is not a full stow throughout the tank-top, the coils are to be stowed in the aft part of the hold. This would not allow the stow to collapse because of the vessel's movement in adverse weather.

HOT AND COLD ROLLED STEEL COILS

If the coils are loaded in a single tier, there shall be always one locking coil. Where there is no space for a locking coil to be used, chocking hardwood timber shall be used or shoring between the two adjacent coils in the middle of the row. As a rule of thumb, the use of a locking coil shall be considered when the space between two adjacent first-tier coils shall be between 30% and 60% of the locking coil width. Another rule is the lower inner edge of the locking coil is to be within the outer and inner edges of the first-tier coils.



HOT AND COLD ROLLED STEEL COILS

There shall be always spacing of between 150mm and 250mm between two adjacent rows:

UNDER-COAMING STOWAGE

For homogeneous cargo loaded throughout the cargo hold in bulk carriers, coils stowed under the coamings cannot be directly lifted by using the vertical plumb of the crane's wire. These coils need to be pulled into the hatch square using forklift trucks, manoeuvring on the tank-top within the hatch square, layer by layer. For coils stowed with the axis in a fore-and-aft direction in the hopper areas, there is no direct lift for the forklift trucks and the possibility of damaging the cargo is increased. In this situation, the forklift truck shall use nylon web or braided wire slings to handle and re-position the coils.

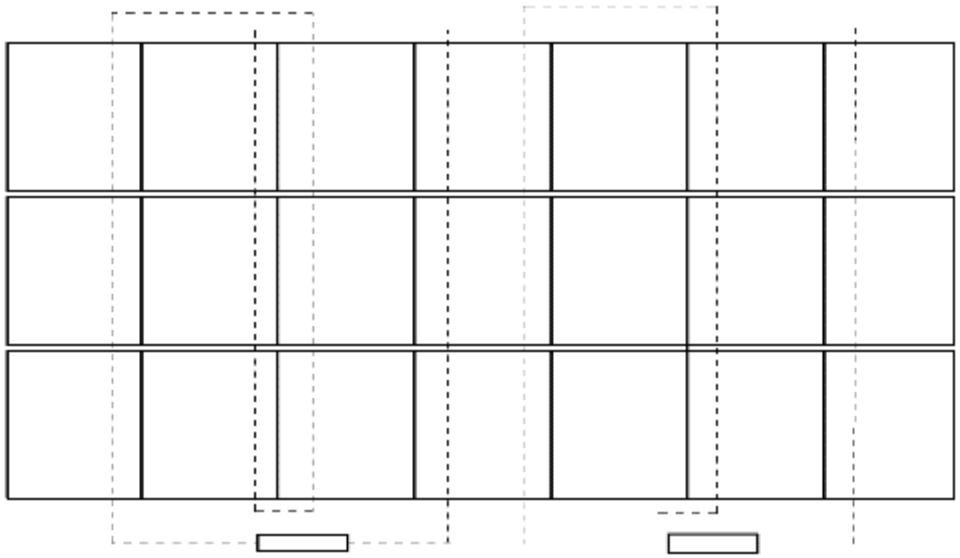
HOT AND COLD ROLLED STEEL COILS

SUGGESTED STOWAGE AND LASHING OF COILS

When the cargo does not form a full load in one hold, to prevent fore-and-aft shifting of the coils, the upper tier of coils shall be lashed using one of the following two arrangements:

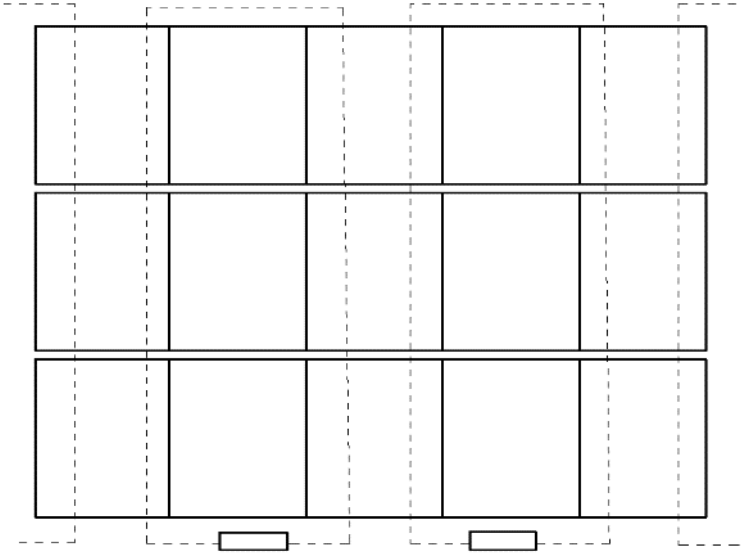
Two and three coils from the second or third tiers in adjacent rows shall also be lashed together to prevent the coils from shifting longitudinally.

Wires with turnbuckles or rigging screws are used. Alternatively, metal strap banding with pneumatically tightened clamps are the more usual option.



Olympic method of lashing with wires or metal strap bands.

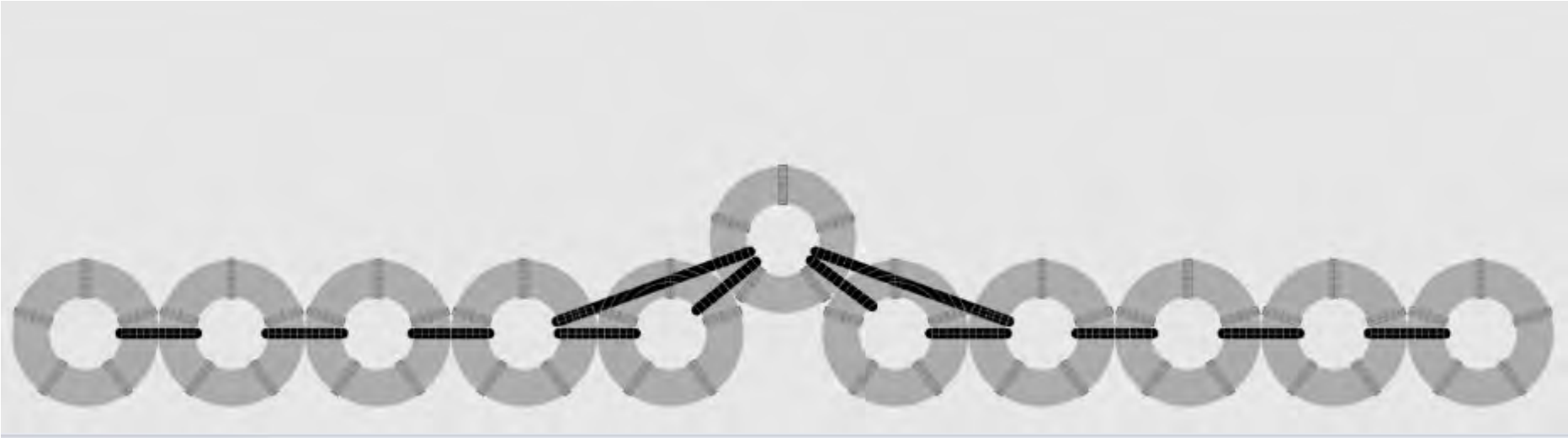
Two and three coils from the second or third tiers in adjacent rows shall also be strapped together to prevent the coils from shifting longitudinally.

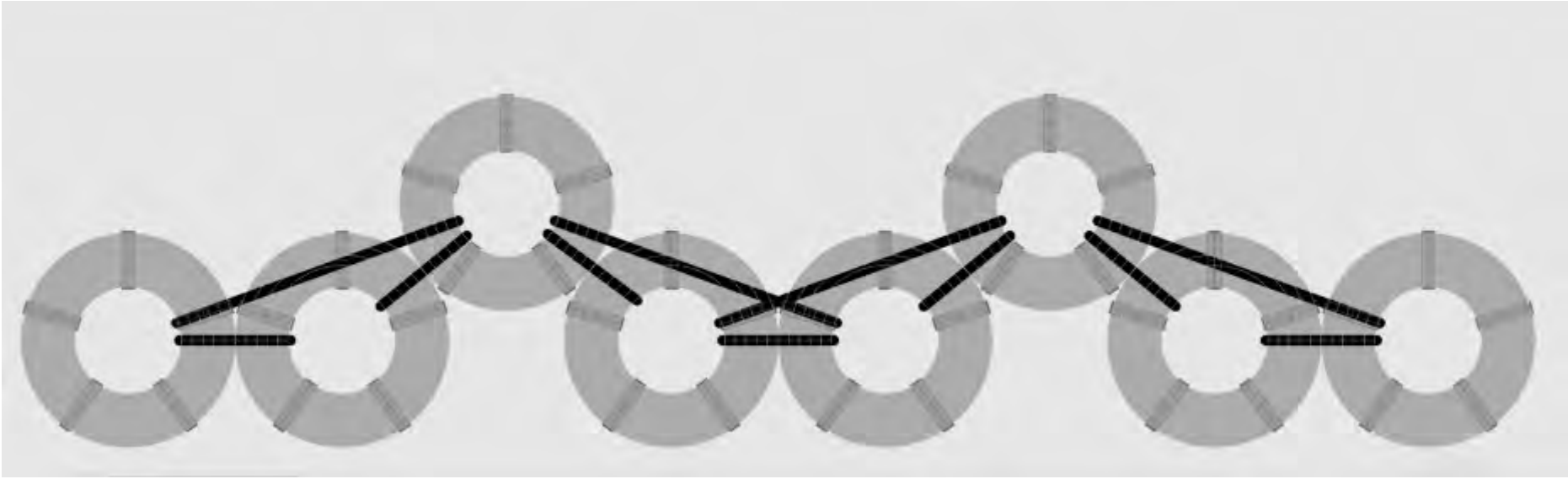


Group method of lashing with wires or metal strap banding.

HOT AND COLD ROLLED STEEL COILS

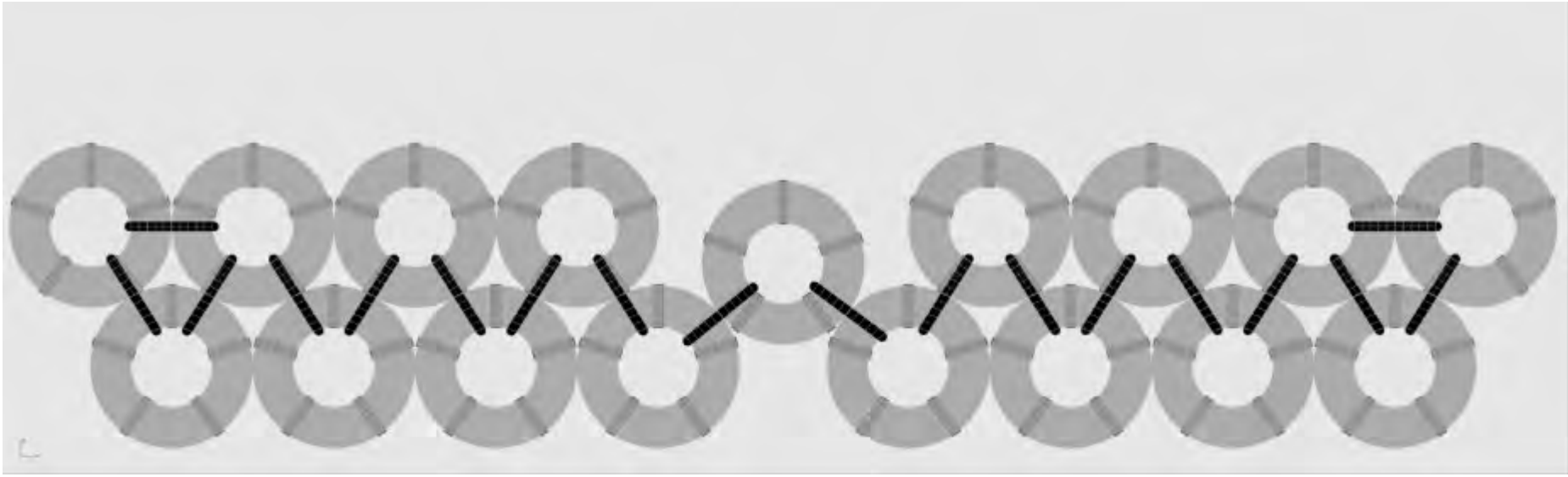
Stowage and lashing of a single tier of heavy coils with one and two locking coils. Medium heavy and heavy coils between 15 and 25 tonnes can be loaded in one to two tiers. Coils of weight more than 25 tonnes shall be loaded in one tier only with one or two locking coils or dunnage structure. Where the vessel's cargo securing manual does not allow for a locking coil to be used, proper dunnage structure must be built.



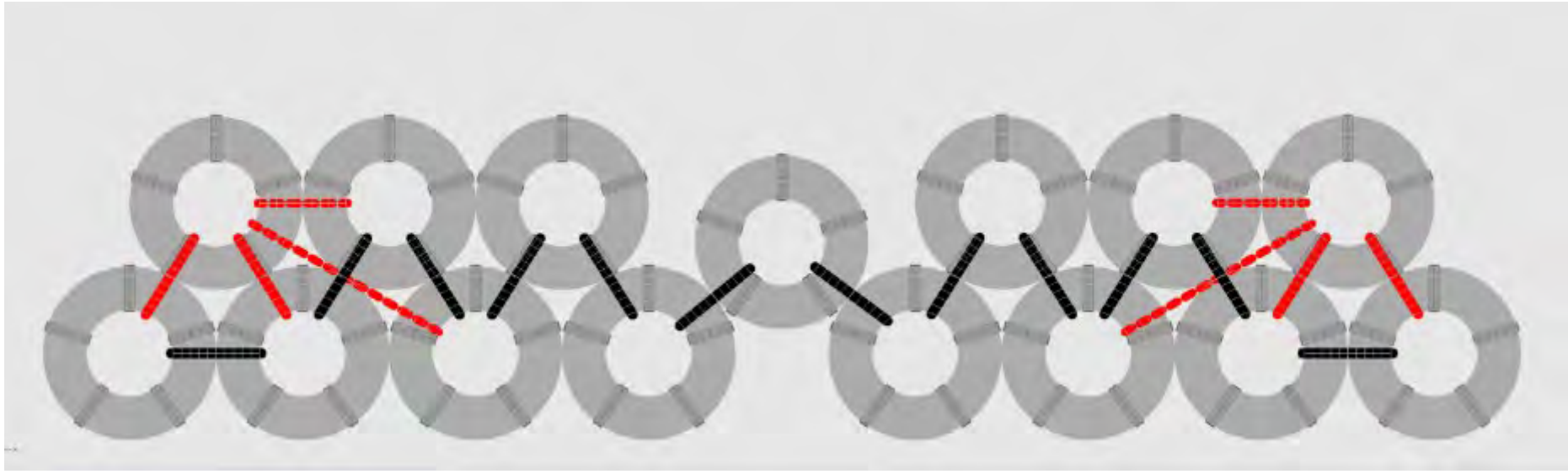


HOT AND COLD ROLLED STEEL COILS

Stowage and lashing of two tiers of coils. Inverted pyramid stow in hopper-type cargo holds.

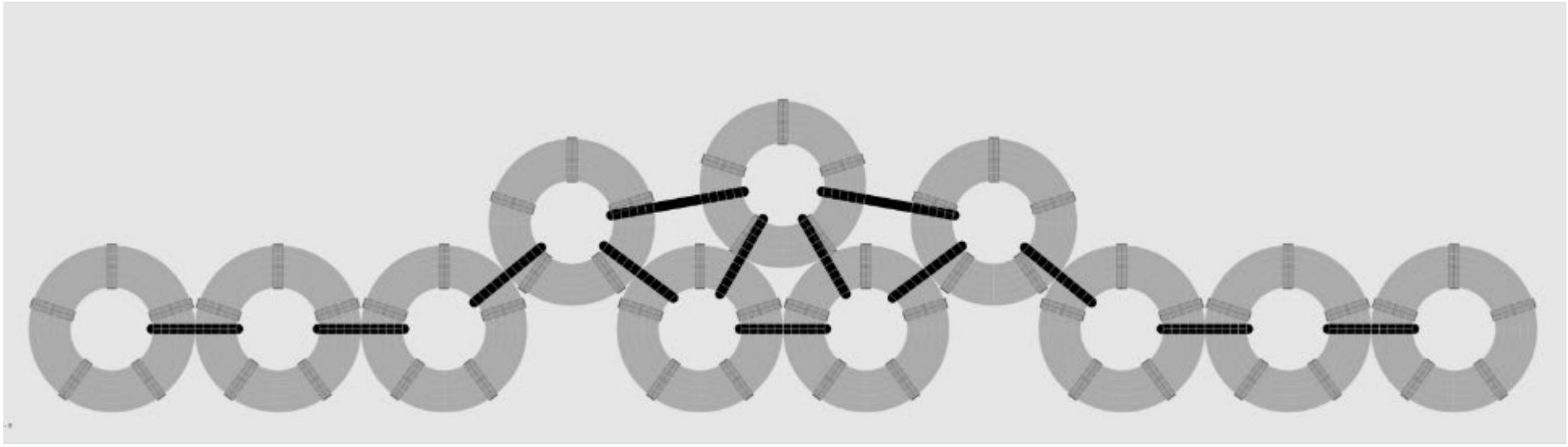


Pyramid stow in hopper-type cargo holds. The two end coils from the second tier shall be secured to three adjacent coils from the first and second tier, or three coils from the first tier only. The red-dotted line indicates that only one lashing is required and not both.

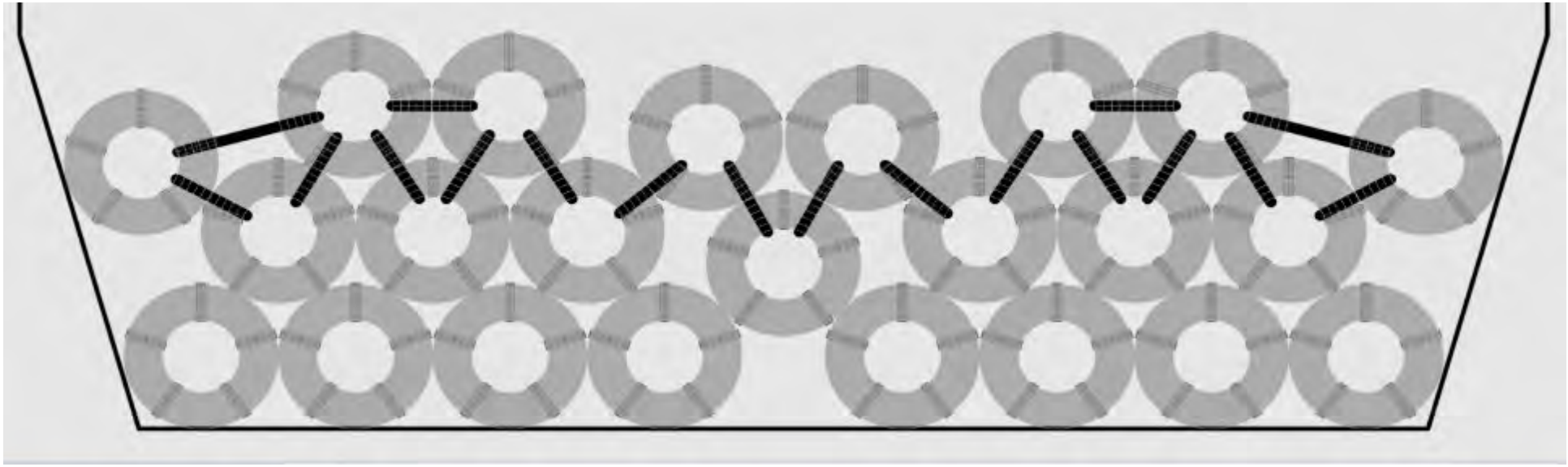


HOT AND COLD ROLLED STEEL COILS

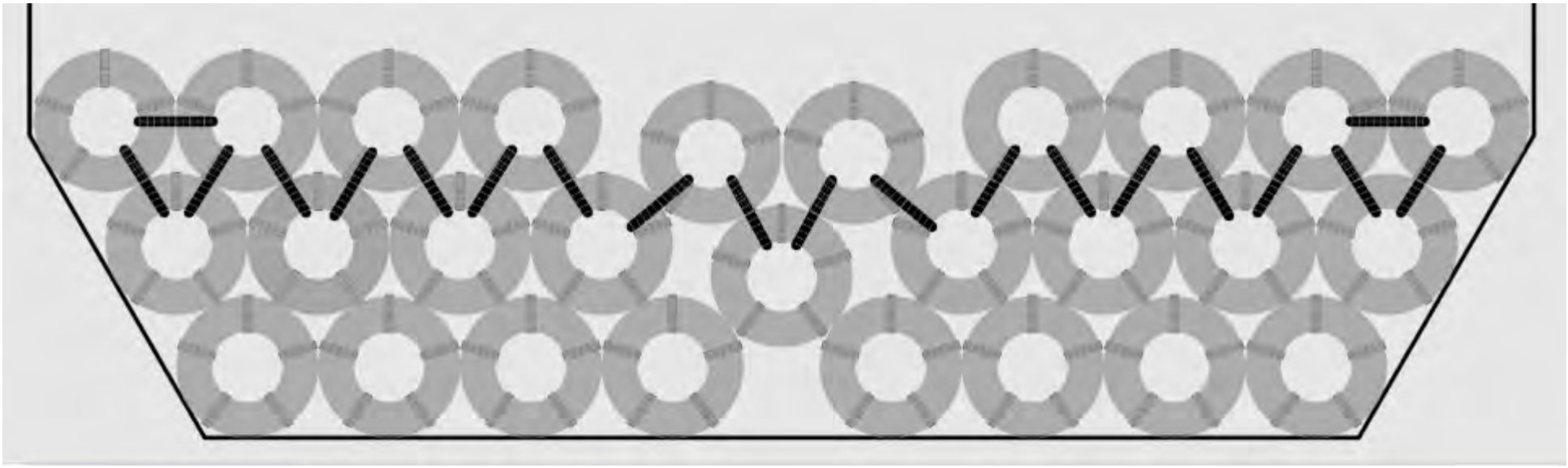
Stowage and lashing of an incomplete second tier of coils with two locking coils.

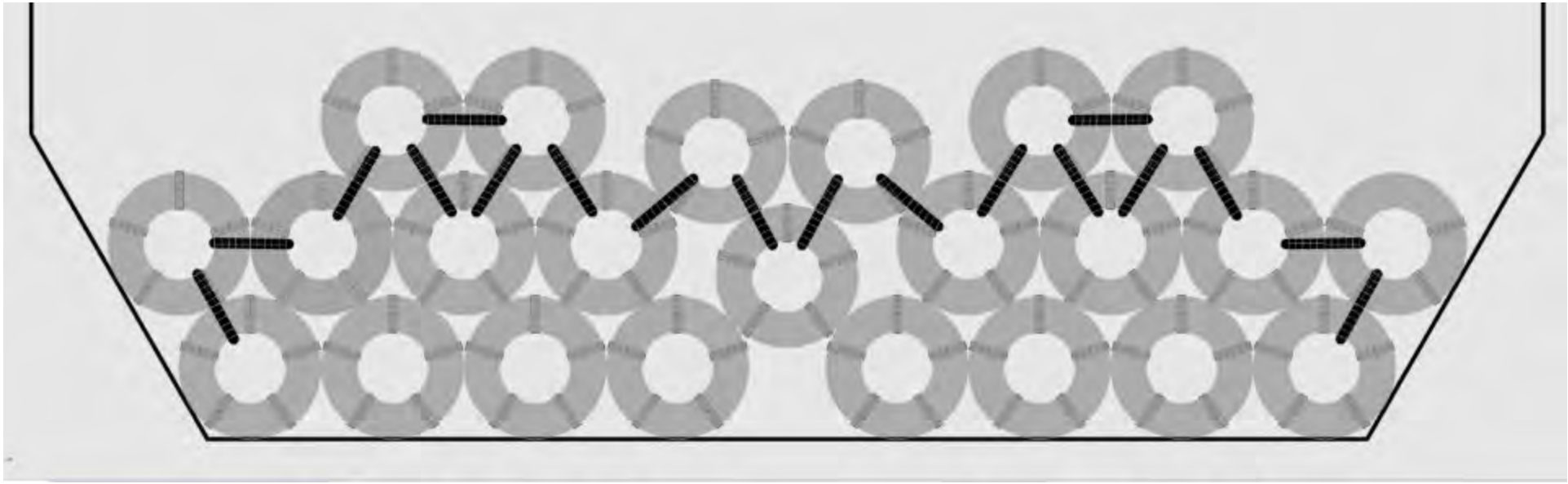


Stowage and lashing of three-tier coils. This loading pattern is to be applied for light and medium light coils of up to 15 tonnes of unit weight.



HOT AND COLD ROLLED STEEL COILS

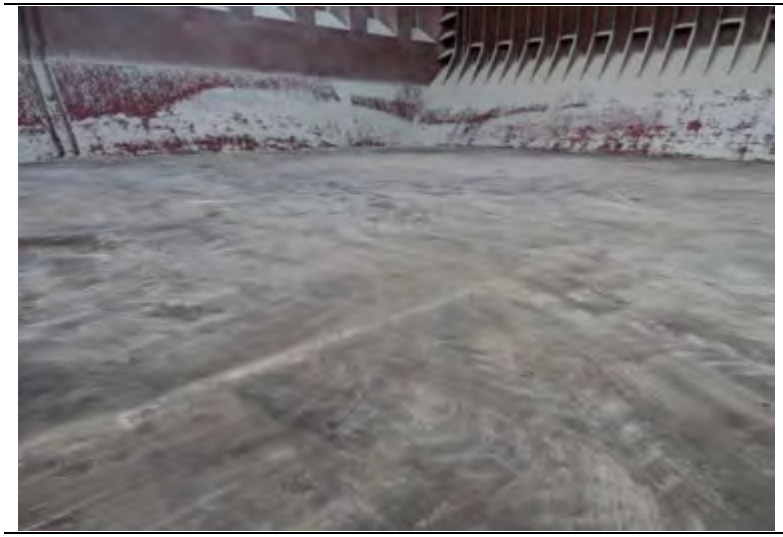




HOT AND COLD ROLLED STEEL COILS

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. The residue from some bulk cargoes can react with, and damage, the steel cargo.

Poorly prepared cargo hold. Again, the cargo residues may react with, and damage, the steel cargo.

HOT AND COLD ROLLED STEEL COILS

CRCs stored in a warehouse prior to the loading.

HRCs stored in a warehouse prior to the loading.

CRCs alongside vessel prior to shipment.

CRCs delivered by a barge.

HOT AND COLD ROLLED STEEL COILS

Lowering of a forklift truck in the cargo hold for stowing the coils.

Use of a forklift truck, equipped with a pole to handle the coils under the coaming area.

Dunnage in preparation for the loading of coils.

Dunnage in preparation for the loading of coils.

HOT AND COLD ROLLED STEEL COILS

First tier of coils. Correct place of the wooden wedge on the dunnage plank. Incorrect positioning with the right angle down. Dunnage too thin.

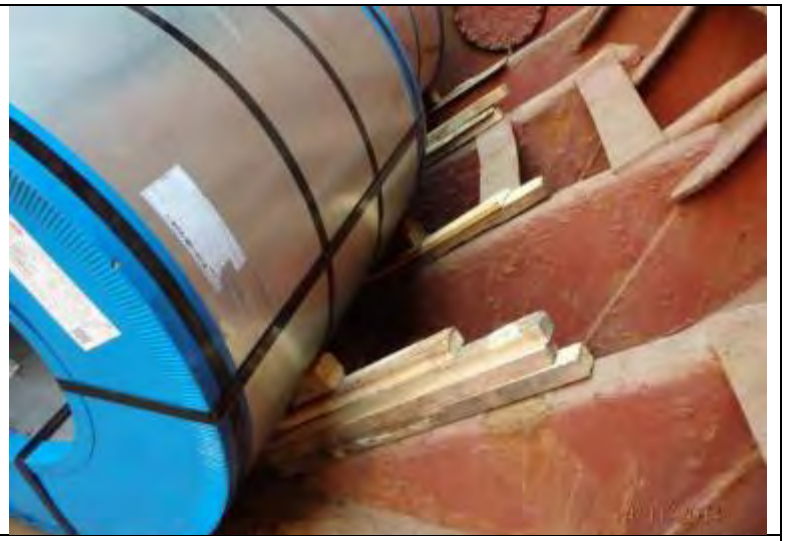
First tier of coils. Correct place of the wooden wedge on the dunnage plank. Incorrect positioning with the right angle down. Dunnage too thin.

First tier of coils. Incorrect place of the wooden wedge on the tank-top. Correct positioning with the right angle up.

First tier of coils. Correct place of the wooden wedge on the tank-top. Correct positioning with the right angle up.

HOT AND COLD ROLLED STEEL COILS

Dunnage used for shoring of HRC. The shoring structure shall be as one block with the front and aft parts. Incorrect use of the bottom wedge.



Dunnage used for shoring of CRC. The shoring structure shall be as one block with the front and aft parts. Incorrect use of the wooden wedges.

Insufficient securing of the dunnage for shoring in one block. Shifted dunnage during the passage.

Correct loading and pyramid stowage of CRCs in fore-and-aft direction in hopper-type cargo hold with flaring of the coils.

HOT AND COLD ROLLED STEEL COILS

First row of HRCs loaded with a locking coil. The locking coil is not positioned in the middle of the row because of the access ladder.

One tier of HRCs with a locking coil in the middle of the row.

The first tier of coils is loaded too close to the forward bulkhead without dunnage. It is good practice to use dunnage between the coils and fore-and-aft bulkheads.

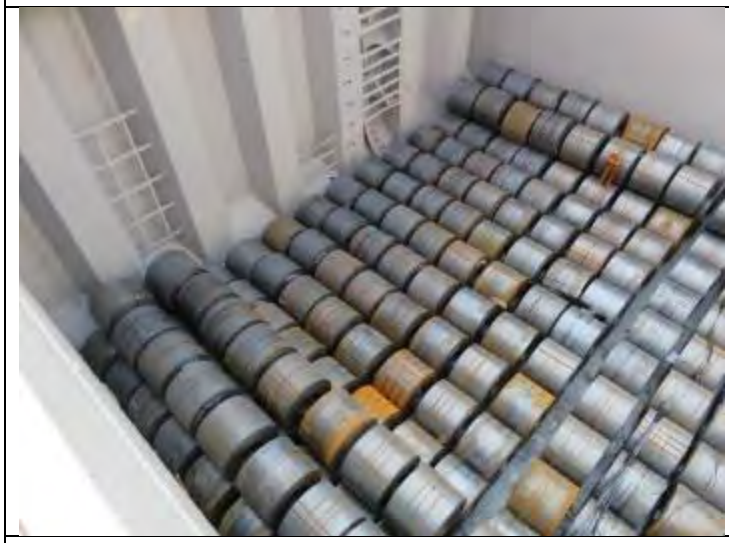
Missing dunnage between the coil and the bulkhead.

HOT AND COLD ROLLED STEEL COILS

Use of forklift truck with a pole to stow the coils.

Homogeneous stow of HRCs prior to the lashing. Sufficient space between the rows allowing for the slings to be passed through the coils.

The HRCs have irregular and insufficient transverse metal straps. Such coils shall not be accepted for loading.



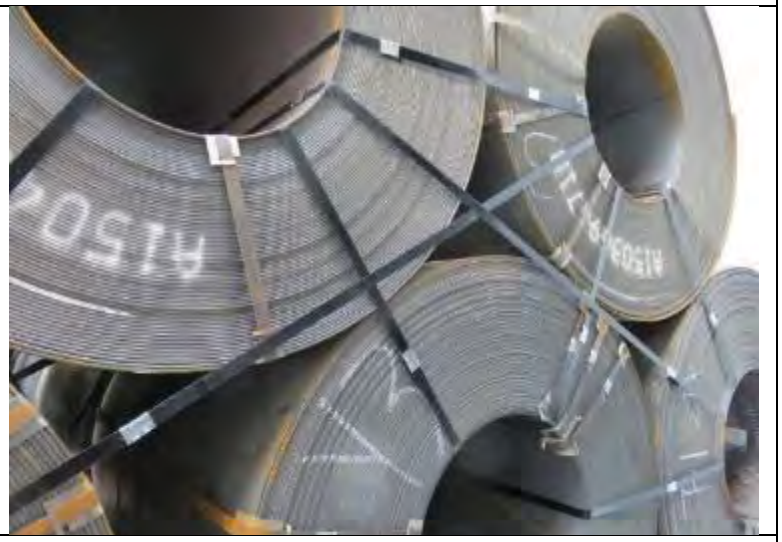
Box-type cargo compartment. A single-tier stow of HRCs without locking coils. The second tier is not complete.

HOT AND COLD ROLLED STEEL COILS

Loading of HRCs in a hopper-type cargo hold. HRCs are generally heavy and three rows of dunnage are not sufficient.

Loading and stowing of CRCs without the use of dunnage.

Insufficient space for a locking coil. No chocking dunnage is used to prevent the coils from shifting.



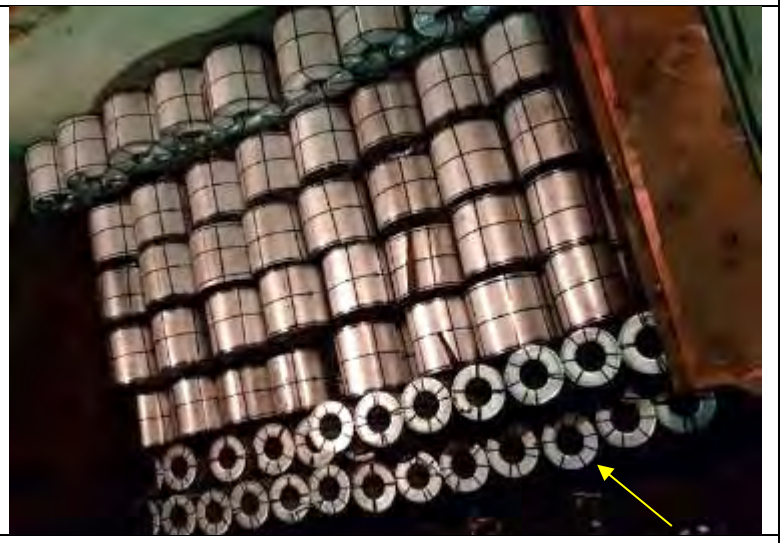
Correct lashing of the second tier of heavy coils. The lashing straps are doubled by way of securing two second-tier adjacent coils. No chocking dunnage is used.

HOT AND COLD ROLLED STEEL COILS

A good pyramid stow of CRCs in the aft most part of a hopper-type cargo hold.

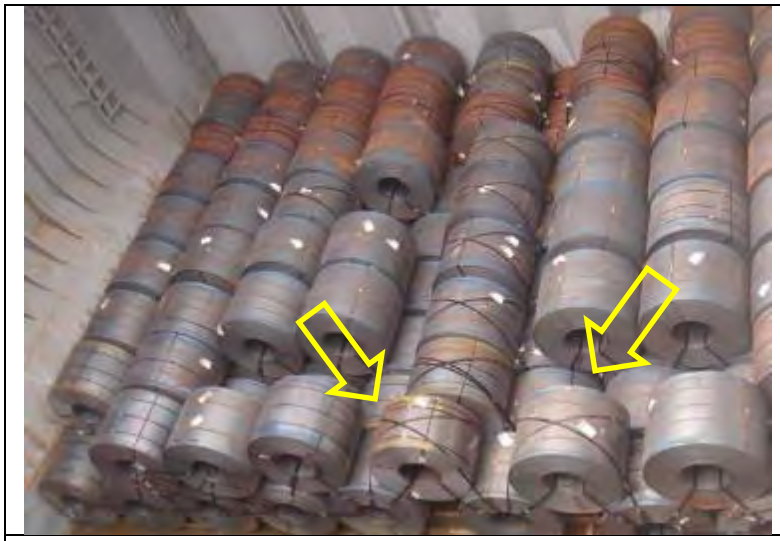
Pyramid stow of CRCs with a third tier of coils with good lashing. The heavy coils are not on top of the lighter ones.

Locking coils or chocking dunnage shall be placed on the first-tier coils in the centre.



Eye to the sky stowage of coils has been discontinued as it requires extensive securing and dunnaging. However, such part-stowage can still be observed.

HOT AND COLD ROLLED STEEL COILS



Correct securing of the locking coils for homogeneous cargo stow in one hold.

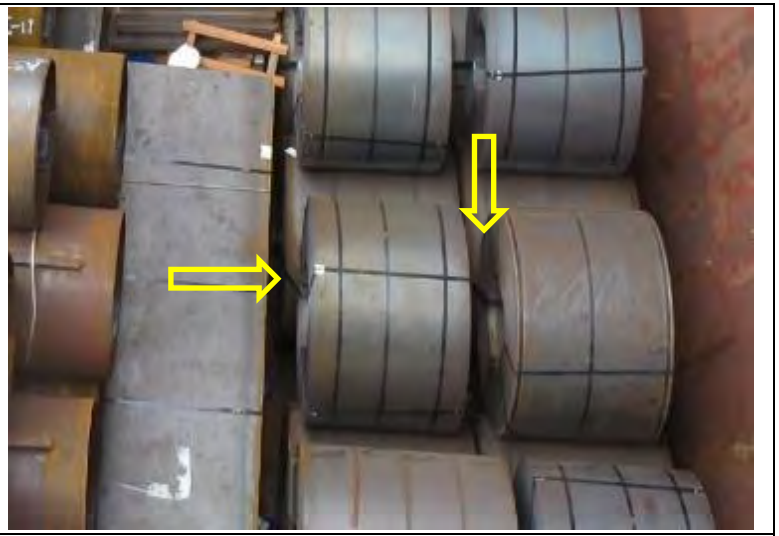
Properly stowed coils with the lighter coils on top of the heavier coils. No use of wooden wedges and shoring dunnage on the hopper tanks.

Handling of HRCs with long braided wire slings without a spreader, which is acceptable. This is not acceptable for CRCs.

Handling of CRCs with braided wire slings and a spreader.

HOT AND COLD ROLLED STEEL COILS

Mixed loading of HRCs with steel plates. No dunnage is used for separation of the two parcels. No dunnage is used between the HRCs and the hold's stool/bulkhead.



The upper-tier coils of the two adjacent rows are not lashed together. Lashing was only used between the tiers in one row.

Ports use nylon web slings for handling HRCs.

Ports use nylon web for handling CRCs. This type of slings is unlikely to damage the coils, even when used without a spreader.

HOT AND COLD ROLLED STEEL COILS

Braided wire sling is passed through the coil in preparation for off-loading.

Off-loading of CRC with braided wire sling and a spreader.

Off-loading of two CRCs with braided wire slings and a spreader.

Using forklift truck with a pole for shifting of the coils under the coaming areas.

HOT AND COLD ROLLED STEEL COILS

Coil damaged by forklift truck when handled from the under-coaming area. The risk of such damage is with respect to the end coil on each side of the first tier.

Use of ladders for access to the top tiers of the coils.

Good stowage of coils with shoring dunnage at the bulkhead and safety access to the top tiers of coils.

Stow of two tiers coils with a safety access to the top tier. Dunnage between the rows.

HOT AND COLD ROLLED STEEL COILS

SUMMARY CHECKLIST

- The loading of coils shall be in accordance with the vessel's Cargo Securing Manual and the CSS Code.
- Coils shall be stowed with their axes in the fore-and-aft direction. The stowing of coils shall start from the side of the hold going inward.
- The maximum number of coil tiers will be determined by the vessel's Cargo Securing Manual and Class. Great care must be taken for the maximum uniformed loading of the tank-top not to be exceeded.
- For part-loaded holds, coils shall be loaded against the aft bulkhead, if possible.
- Cargo of coils shall ideally not be overloaded with other cargoes. Coils must not be loaded on top of other cargoes.
- Two adjacent coil tiers shall have space to allow for passing the slings through the coils.
- Depending on the width of the coils, two, three or four wooden planks shall be laid on the tank-top. The size of the planks shall be 150mm x 50mm (6" x 2"). The length of the planks shall allow for locking wooden wedges to be placed under the coils.
- Wooden wedges shall be used to lock the coils from the inboard side of the coils. These shall be correctly placed on the wooden planks and nailed, if possible.
- Each end coil on the first tier shall rest on dunnage placed on the side bulkhead and the adjacent coil. The other coils shall rest on two adjacent coils.
- Dunnage between tiers is not required.
- The first tier of coils shall be locked with one or two locking coils, depending on the space. Where a locking coil cannot be used, proper hardwood dunnage between two adjacent coils shall be used.
- For second-tier coils, each end coil shall be lashed to three adjacent coils, one from the second tier and the two lower-tier coils. Alternatively, the coil shall be lashed to the three lower-tier coils.
- 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.

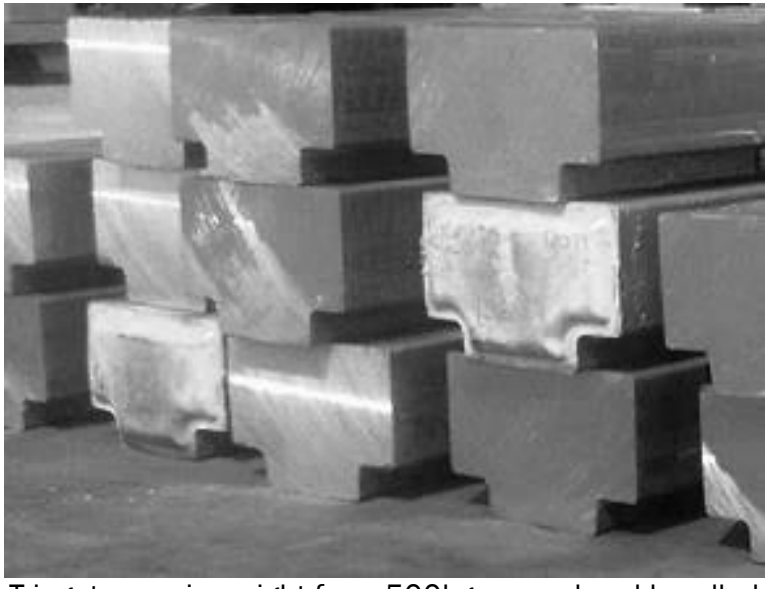
INGOTS, BILLETS, BLOOMS, SLABS

GENERAL

Ingots are an unfinished product, usually shipped in various sizes and weights. Ingots may be made of steel, zinc, aluminum, lead, copper and various alloys. Billets, blooms and slabs are semi-finished products made from the ingots.

The ingots in general are very heavy and vary in weight and profile. The smaller ingots weigh between 12kg and 15kg (small ingots), mid-weight ingots are above 20kg and the so-called T-ingots generally weigh between 550kg and 820kg, and sometimes more. The lighter and medium-weight ingots are usually tightly bundled or palletized into a unit weight of approximately 1 tonne, whilst the T-ingots are handled individually. Bundling is usually made with high-tensile metal strapping or high-strength polyester strapping in a vertical pattern of 2 + 1 straps per one bundle of ingots.

For example, Jurong Port does not usually handle slabs, blooms and billets; however, these cargoes may be handled as part of a re-exporting process. The port regularly imports aluminum and other types of various sized ingots.



T-ingots vary in weight from 500kg upward and handled individually.

Medium-weight aluminium ingots stored in the open.

INGOTS, BILLETS, BLOOMS, SLABS

Billets are normally shipped as unwrapped and unprotected cargo units. Their usual size is about 150mm x 150mm, and can be up to 12 metres long. A single billet weight may be up to 1 tonne. The billets may be bundled with the use of wire rod, thus forming heavy units with a small stowage factor.

Blooms may be of square or circular cross-section. These are also shipped unwrapped and unprotected. The usual size is 230mm x 230mm. A single bloom may weigh up to 2.5 tonnes and up to 6 metres in length. Each bloom is heavy and shall be handled with care. Circular aluminum blooms may be bundled together with the dunnage, for ease of handling with forklift trucks. Bundling is usually made with high-tensile metal strapping or high-strength polyester strapping of approximately 19mm wide and 1 tonne breaking strength.

Slabs are usually made to a pre-determined specification. The unit size is typically 250mm thick and 2500mm wide. The length varies and a unit weight may reach 20 tonnes. Slabs are not bundled.

Billets

Square Blooms

Slabs

INGOTS, BILLETS, BLOOMS, SLABS

DUNNAGE

Ingots, billets, blooms and slabs tend to shift, if not correctly dunnaged, as there is very little friction between units laid directly atop each other. T-ingots and slabs are typically carried loose. Smaller ingots, blooms and billets may be strapped in tight bundles or packages. In accordance with industry good practice, good, dry, hardwood dunnage shall be used throughout, as softwood dunnage is too easily crushed or damaged.[9]

Dunnage shall be laid in rows on the tank-top in an athwartships direction under each row of pallets. Generally, 150mm x 150mm is the minimum preferred cross-section to be utilized at the tank-top to provide resistance to the weight of the stow. Dunnage shall be placed between individual tiers. Wooden chocks shall also be placed between the units and bundles/packages on every tier. The cargo is generally heavy and, therefore, care shall be exercised for the tank-top strength. Dunnage may also compress in transit and cause the cargo stow to loosen and shift.

Because of the size and weight of the ingots, these shall preferably be loaded in a box-type cargo compartment only, and across its full width. Where there are gaps between the cargo units, proper dunnage chocking shall be applied. Similar dunnage shall be placed against the inner shell plating and bulkheads and the internal vertical frames. The higher or heavier the intended stow, the more dunnage shall be used on the tank-top and in the lower tiers.

For the loading of T-ingots, thick plywood dunnage may be used on the tank-top for the first tier of cargo. The reason for this is to provide sufficient friction between the cargo units and the tank-top, while the weight is distributed over a large surface area and not only on the dunnage boards. It is also recommended that plywood sheets are used for the subsequent tiers.

For the loading of ingot bundles and because of their size, it is usually easy to make a compact stow throughout the width of a box-type cargo compartment. Dunnage shall be used to protect the bulkheads and frames. If the stow is not tight, dunnage chocking shall be applied where necessary to avoid loose bundles and prevent shifting.

For the loading of billets, blooms and slabs, plywood dunnage sheets shall not to be used. For bulk carriers, dunnage shall be placed on the hopper tanks and shall be sufficient to provide effective protection for ship and cargo in the event of heavy weather on voyage.

A full stow of small-size ingots in bundles. Choking dunnage used in the stow, and shoring dunnage used against the bulkheads.

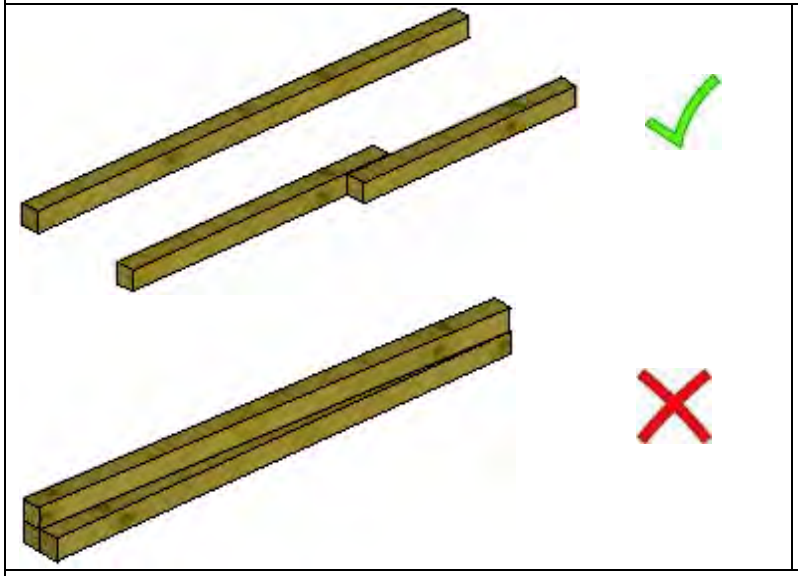
[9] Lloyd's Practical Shipping Guides – Steel: Carriage by Sea, 5th Edition 2009 (A. Sparks & F. Coppers).

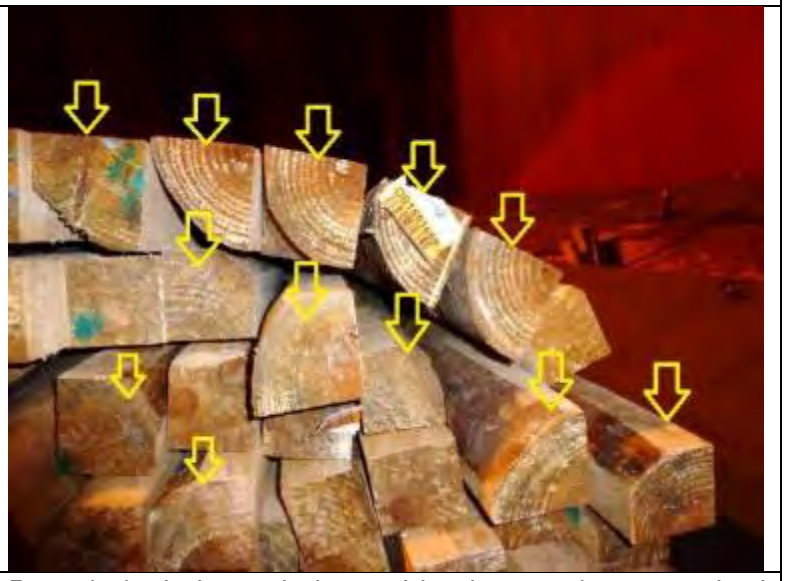
INGOTS, BILLETS, BLOOMS, SLABS

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

Good, dry, hardwood dunnage shall be used of minimum 150mm x 150mm cross-section.

The length of the dunnage shall be sufficient to provide good overlapping for slabs. 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.

INGOTS, BILLETS, BLOOMS, SLABS

LASHINGS

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

When the cargo of ingots is stowed across the full width of the cargo hold, the stow is prevented from shifting by the friction resistance of the timber dunnage used and chocking timber dunnage used to block the top tier. Wire or chain lashings may not be used for a stow of ingots if loaded throughout the width of a box-type cargo compartment.

For stows of billets, blooms and slabs, this type of lashing is important to secure the stow in a single block and prevent the initial movement. 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 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. Metal steel straps are not recommended to be used for lashing, particularly for heavier units. Because of their weight, the dunnage tends to compress and to loosen the ingots stow (UK P&I Club "Carefully to Carry").

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.

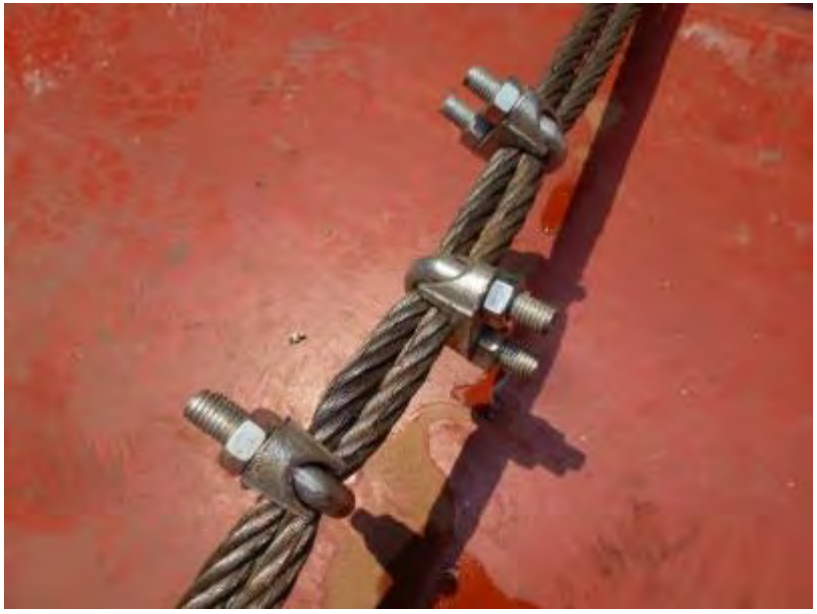
INGOTS, BILLETS, BLOOMS, SLABS

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.

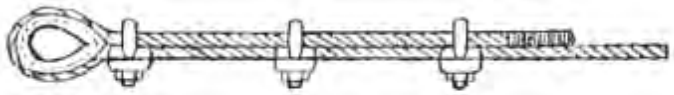
The bolts should be tightened sufficiently to compress the wire to $^2/_3$ of its nominal diameter. For lashing ingots, billets, blooms and slabs loaded throughout the full width of a cargo hold, 3 bulldog grips are considered to be sufficient for a 16mm wire. For stows not covering the full width of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



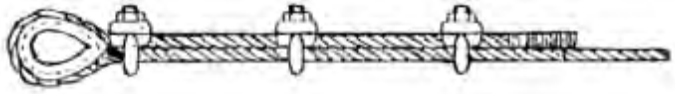
Incorrect way of using bulldog grips.

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

INGOTS, BILLETS, BLOOMS, SLABS



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.

INGOTS, BILLETS, BLOOMS, SLABS

STOWAGE

All cargo shall be stowed in accordance with the IMO Code of Safe Practice for Cargo Stowage and Securing (CSS Code). Bundled or palletised ingots may be stowed athwartships to suit the loading requirements. Where individual or bundled ingots are to be stowed over the sloped hopper tanks of bulk carriers, proper dunnage foundation structure shall be built to protect the structural integrity of the tanks and to keep the stow upright. T-ingots may be gradually winged over the hopper tanks. The stowage shall start from the sides towards the middle of the cargo holds.

Slabs, billets and blooms may be loaded in the fore-and-aft direction, as well as athwartships. The weight shall be evenly distributed throughout the cargo compartment. Overhung first-tier cargo units, slabs, shall be supported underneath by solid dunnage constructions to allow proper weight distribution and allocation.

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 cargo compartment 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.

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 shall 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 bundles and single units will inevitably move.

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

California block stowage shall be avoided for the loading of slabs. In general, slabs are loaded similarly to the steel plates, and the tiers shall ideally overlap to form a uniform brick wall type of stow.

Ingots are usually handled with chain slings. When palletised, the pallets may be pre-slung for direct overhead handling. Billets and blooms may be handled with chain slings using a choke hitch.

Handling aluminium T-ingots with chain slings.

INGOTS, BILLETS, BLOOMS, SLABS

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 wing spaces to the open hatch square. In order to facilitate the off-loading of such cargo, forklift trucks are utilized.

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

Small-size bundled ingots and T-ingots being handled, by a forklift truck, from the wing space.

INGOTS, BILLETS, BLOOMS, SLABS

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.

INGOTS, BILLETS, BLOOMS, SLABS

Unbundled T-ingots delivered in port.

Unbundled ingots, ready for shipment and handled by a forklift truck at the quay.

Bundled, long round aluminium billets handled with forklift truck and prepared for loading.

Billets stored at the quay, ready for loading.

INGOTS, BILLETS, BLOOMS, SLABS

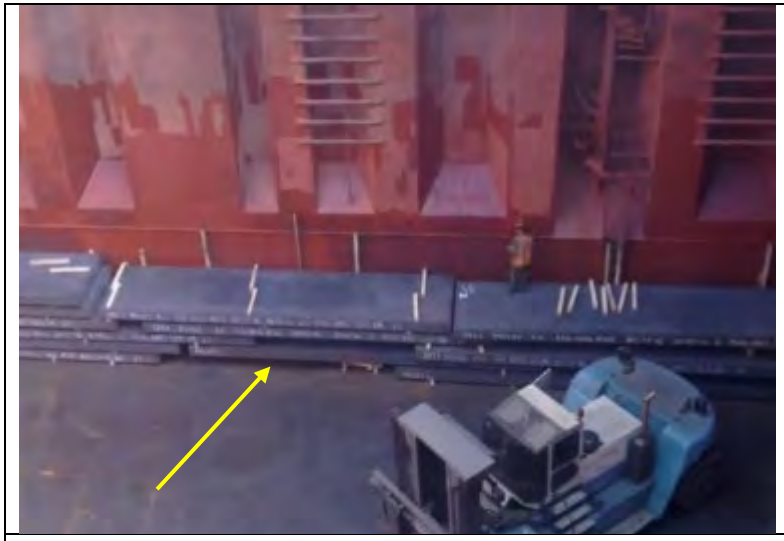
Loading of slabs in progress. Good, square, hardwood dunnage is used between the tiers.

Loading and stowage of slabs in a hopper-type cargo hold. Proper dunnage shall be used on the tank-top. The spacing shall be a maximum of 2 metres.

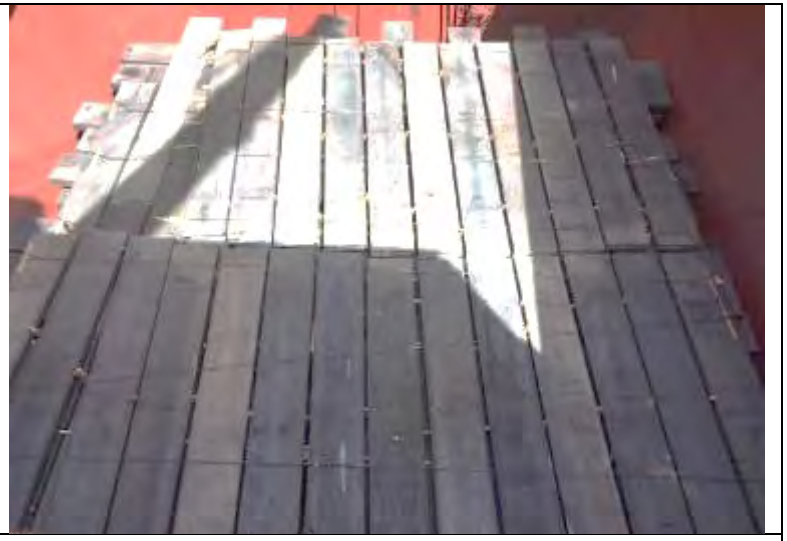
An athwartships stow of slabs. Proper use of dunnage.

A fore-and-aft loading of slabs. Proper use of dunnage.

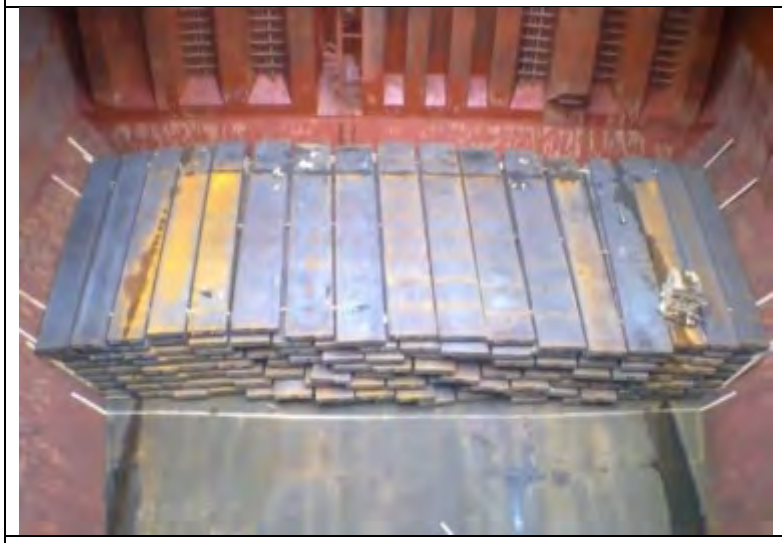
INGOTS, BILLETS, BLOOMS, SLABS



An athwartships stow of slabs. The second tier of slabs is not supported with proper dunnage structure underneath for good weight distribution.



Completed stow of slabs being laid in an athwartships and fore-and-aft directions. The stow is properly lashed with wires, bulldog grips and turnbuckles.



A final stow of long slabs with dunnage and parcel segregation marks. The slabs are winged out over the hopper tanks.

A properly chocked full stow of slabs in a box-type cargo compartment. This stow does not need wire lashing.

INGOTS, BILLETS, BLOOMS, SLABS

Loading of billets in a box-type cargo compartment. Hardwood dunnage is laid on the tank-top. The spacing does not exceed 1.5 metres. Lashing is prepared.

Loading billets with the use of a single chain-leg basket lift under a spreader.

Dunnage is used between each tier of billets to ensure level tiers and ease of handling with a forklift truck during off-loading.

Loading billets with a spreader and chain slings. Square hardwood dunnage shall be used for each tier of billets.

INGOTS, BILLETS, BLOOMS, SLABS

Handling of small-size palletised aluminium ingots. The tiers are segregated by wide wooden planks as dunnage. Each tier is individually levelled. Dunnage is used for gaps.

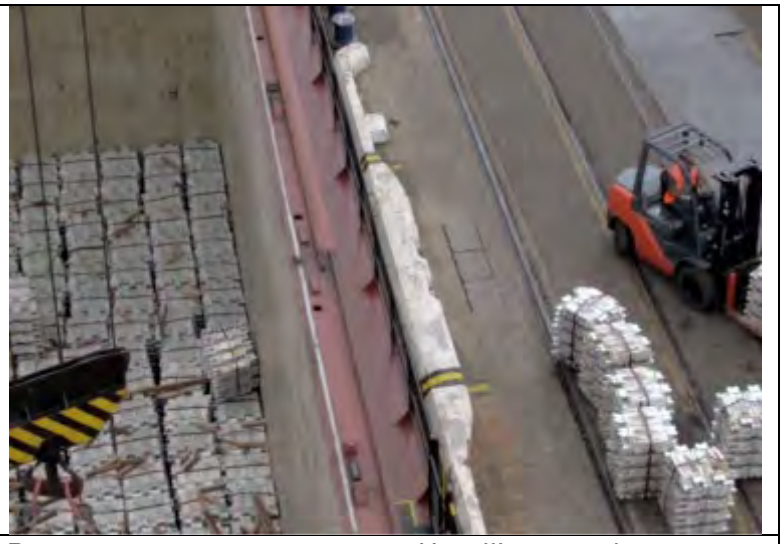
Proper use of dunnage between the tiers. Dunnage is also used on the side frame construction to ensure proper protection of bulkheads and frames, as well as ensuring vertical stow of the ingots.

Off-loading small-size palletised ingots with the use of a forklift truck.

Handling pre-slung, bundled medium-size ingots.

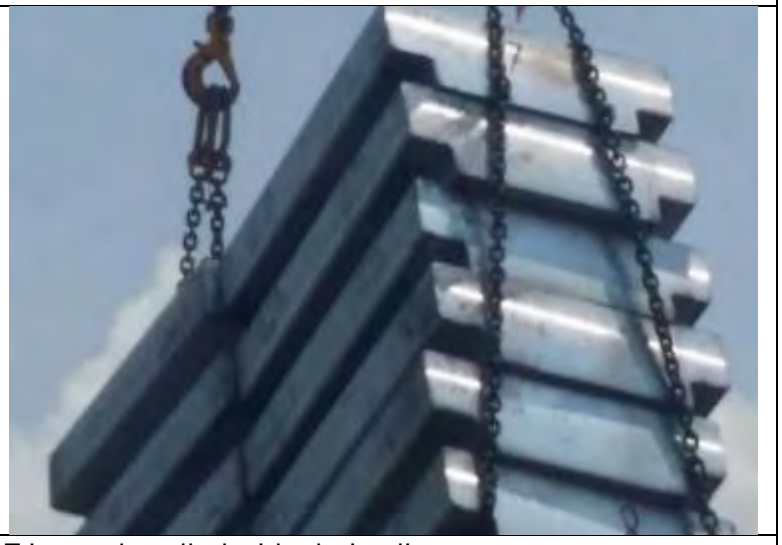
INGOTS, BILLETS, BLOOMS, SLABS

Handling pre-slung, bundled medium-size ingots.



Box-type cargo compartment. Handling pre-slung, bundled medium-size ingots.

Handling pre-slung, bundled medium-size ingots. Loading on a trailer for further storage in a warehouse.



T-ingots handled with chain slings.

INGOTS, BILLETS, BLOOMS, SLABS

Handling of unbundled heavy T-ingots with the use of a chain sling.

Pre-slung T-ingots for first off-loading. Once the first units are removed, the remaining units are handled with a forklift truck.

The use of a forklift truck for the off-loading of T-ingots from a box-type cargo compartment. The stow is full and compact.

Preparation of chain slings for off-loading of ingot bundles.

INGOTS, BILLETS, BLOOMS, SLABS

Use of forklift trucks for off-loading bundled ingots and T-ingots from a box-type cargo compartment.

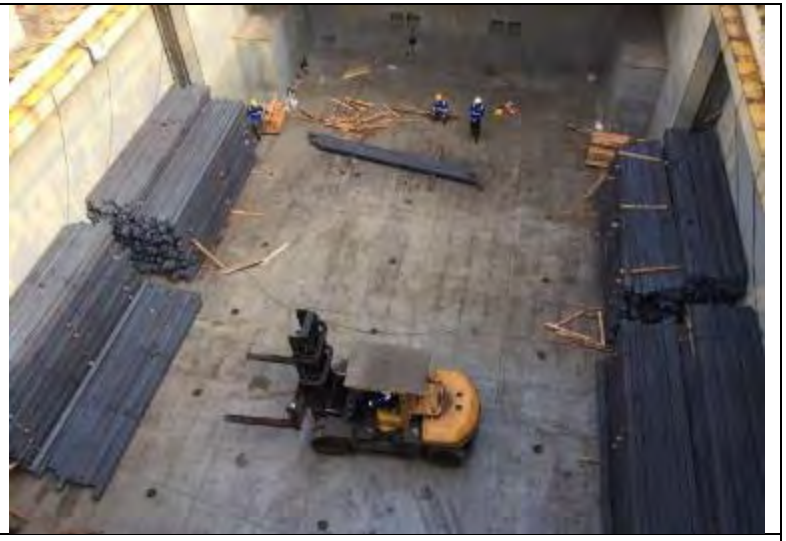
Further transportation of T-ingots to warehouse.

Off-loading billets with the use of a choke hitch.

Off-loading and handling of blooms.

INGOTS, BILLETS, BLOOMS, SLABS

Off-loading blooms with the use of a single chain-leg basket lift under a spreader.



Handling of blooms inside the cargo compartment in preparation for off-loading.

Blooms off-loaded ashore.

Blooms off-loaded ashore.

INGOTS, BILLETS, BLOOMS, SLABS

SUMMARY CHECKLIST

- The tank-top load limits not to be exceeded. Consideration to be given to the hopper areas, where the load limits may be smaller.
- The tank-top to be prepared with appropriate hardwood dunnage to prevent the billets, blooms and slabs from shifting. The size of the dunnage shall be, as a minimum, 150mm x 150mm. The spacing of the dunnage shall not exceed 2 metres.
- Plywood sheets of dunnage shall be used for the loading of T-ingots and ingots in bundles and pallets on the tank-top and between the subsequent tiers. Wood planks of size 200mm x 20mm may be also used between the tiers of bundled ingots.
- Softwood dunnage shall be used between the bulkheads/frames and the stow. The dunnage construction shall be such that it will assist the stow to remain vertical during the voyage.
- Lashing wires at a spacing not more than 3 metres to be positioned on the tank-top in preparation for the final lashing of a stow of billets, blooms and slabs. Where the slabs are loaded across the full width of a box-type cargo compartment, and proper chocking is made, lashing may not necessarily be used.
- The full stow of ingots may not require lashing; however, proper vertical dunnage for chocking and preventing the stow from shifting shall be applied.
- All tiers of ingots, billets, blooms and slabs shall 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.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

GENERAL

Mixed loading of different steel cargoes in one cargo compartment shall always subject to proper planning, correct stowage, securing, dunnaging and lashing. In general, where the cargo parcels cannot be segregated horizontally, vertical segregation, can be considered.

Where horizontal segregation is possible, the cargo units should ideally form a single stowage block, or parcel, and the relevant principles and guidance for the loading of that cargo, in homogeneous form, shall be referred to and applied.

Combined vertical loading of steel cargoes may involve some, or all, of the following products:

1. Steel Plate in Sheets.

2. Reinforced Bars (Rebar).

3. Wire Rods in Coils (WRIC).

4. Steel Plate in Coils.

5. Steel Pipes.

6. Structural Steel Products.

When combined stow is considered for loading, the individual guidelines for the loading, stowage, securing and dunnaging of the revelant individual cargoes shall be also adhered to.

DUNNAGE

When loading a combined stow of various steel cargoes, dunnage is variously required as follows:
- to assist in the building of a single stowage block,
- to prevent the cargo from shifting in transit,
- to level the cargo tiers,
- to protect the vessel's structures and cargoes from damage,
- to allow for easy access and handling of the cargo,
- to segregate the individual parcels from one another,
- other reasons, as may be deemed necessary.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

In accordance with industry good practice, good, dry, bark-free dunnage shall always be used. Hardwood dunnage is to be placed on the tank-top as softwood dunnage is too easily crushed or damaged. The dunnage used for the lower stow shall always be in accordance with the relevant guidance for the loading and stowage of that cargo. Depending on the total combined weight of all cargo on the cargo hold tank top, hardwood dunnage shall be considered for use throughout the lower stow. Softwood dunnage may be used for the upper areas of the stow, depending on the weight it will have to bear.

Dunnage shall be used on the hopper tanks and side bulkheads.

There shall be sufficient dunnage between the two stows of different types of steel cargo. Generally, square hardwood dunnage of 100mm x 100mm size shall be used. Since combined stows would normally be loaded in a fore-and-aft orientation, dunnage would be lain in an athwartships direction. The purpose of the dunnage is to ensure the first stow is levelled and ready for the loading of the upper stow. The dunnage for the upper stow shall also follow the relevant guidelines for that type of cargo.

Where shoring is required to be built between the stows and the bulkheads, it must be constructed in such a manner that there is no risk of it slipping or loosening-up. This is particularly relevant for hopper-type cargo holds, where the contact between the dunnage and the hopper-plating may not be perpendicular, because of the slope of the hoppers.

For steel coils and non-bundled pipes, wooden wedges shall be used to lock the coils and pipes in position. Wooden wedges shall be also considered between the tiers of pipes.

Dunnage structures shall be built underneath overhanging parcels, that are stowed on top of shorter parcels. This is particularly required when structural steel products and pre-fabricated units, are loaded over other steel cargo types.

With respect to the loading and stowing of WRICs, plywood dunnage sheets are normally used. Where this cargo is loaded on top of steel coils or large diameter pipes, plywood may also be necessary to prevent damage to any coatings on the coils or pipes. If the WRICs are loaded into the cantlines of Hot Rolled Coils, then dunnage may not be required.

LASHINGS

When loading combined stows of various steel types, lashing is required and used for a variety of reasons:
- to assist in the building of a single stowage block,
- to prevent the cargo from shifting in transit,
- to protect the vessel's structures and cargoes from damage,
- to segregate the individual parcels from one another,
- other reasons, as may be deemed necessary.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

When two different steel products are loaded as a combined vertical stow, the lashing in general is made in accordance with the guidelines for loading a homogeneous cargo of the same type. The two stows shall be lashed individually. This is particularly important when the lower stow is not off-loaded with the upper stow in the same port. In this situation, it must be confirmed that the remaining stow(s) are properly secured and lashed prior to the departure of the vessel from that offloading port.

The lashing materials are described in the relevant guidelines. The most commonly used lashings are wires of up to 19mm size, turnbuckles, rigging screws, bulldog grips, steel strapping bands (for coils). Pneumatic tools must be used for the tightening of the steel strapping bands.

Copies of all certificates of the lashing materials are to be requested and presented to the master prior to the vessel's departure. For details of the lashing and the materials used, reference shall be made to the relevant guidance for homogeneous loading of steel cargoes.

BUNDLING

Steel cargo units may be bundled together for easy handling and stowage. Various sizes of pipes, rebar and structural steel may need to be pre-slung for ease of the off-loading. The bundles and slings shall be certified. Details of the bundling are provided in the relevant guidelines for the homogeneous stows of steel cargoes and shall be referred to.

STOWAGE

As a basic rule of thumb and industry best practice, heavier cargo units shall be loaded under lighter cargo units. Heavier cargo parcels shall also be loaded under lighter cargo parcels. By heavier cargo, it is understood that the cargo unit has a smaller stowage factor. Similarly, the lighter cargo is the one with a higher stowage factor.

The maximum uniform loading allowance of the tank-top shall never be exceeded by any combination of cargoes. It should be born in mind that the hopper areas may have smaller maximum loading allowance than the tank-top.

The requirements of the Cargo Stowage and Securing Code and the vessel's Cargo Securing Manual shall always be complied with. The summary below provides additional recommendations and guidance for the various combinations.

If the lower stow are parcels of rebar, pipes or structural steel products, these shall be loaded in a fore-and-aft direction over the full width of the cargo compartment. Where the lower stow is of steel plates, these may be loaded and stowed in both longitudinal and athwartships directions. The lower stow must be properly levelled prior to the loading of an over stow.

Steel coils and WRICs are generally stowed longitudinally as homogeneous cargo stows. It is not unusual, however, to stow lighter steel cargo parcels on top. If this is to be done, the upper cargo units, such as pipes, shall be stowed longitudinally in the coils' cantlines.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Steel plates, structural steel products and rebar shall not be stowed atop of steel coils or WRICs. Steel coils and steel pipes shall not be stowed atop of WRICs. Because of their higher stowage factor, the loading of WRICs is possible on top of most of the structural steel products, with the exception of prefabricated steel structures.

Wherever possible, longer steel units should not be loaded on top of shorter products, thus avoiding overhangs. If this is unavoidable, then dunnage (or other) support of the overhang shall be considered and used if appropriate. Pipes, rebar and structural steel products are good examples of cargo units stowed on top of other steel cargoes or being over stowed. Cargoes with protruding/overhanging ends shall be supported in this manner.

If the upper stow is not sufficient in quantity to cover the whole width of the cargo compartment, it must be loaded, lashed and secured within the open hatch area, and not in the under-coaming areas.

Two or more steel cargo parcels, when loaded in one cargo compartment, shall ideally be horizontally segregated, such as un the fore and aft direction. Where this is possible, each parcel shall be loaded, stowed, dunnaged, lashed and secured as a homogeneous block, across the full width of the cargo hold. A clearance of at least 1 meter shall then be allowed between each of the longitudinal stows. Where, for any reason, there is two or more transversely adjacent stows no minimum clearance between the parcels is required. One cargo type shall not act as dunnage, or support, for another, and proper vertically constructed dunnage is still required between the two parcels.

UNDER-COAMING STOWAGE

For cargoes loaded in the under-coaming areas of bulk carriers, the use of forklift trucks will, in most of cases, be necessary. For this reason, working steel plate platforms may be necessary to ensure the protection of the lower stows and to provide maneuverability for the truck.

The under-coaming stows must be well dunnaged between the tiers, levelled and lashed to provide stability during the off-loading operation. Wooden wedges must be used between the tiers of unbundled pipes.

Under-coaming cargoes must be pre-slung, where possible. Particularly for rebar, pipes and structural steel products.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

The matrix below indicates which cargoes may be considered for loading on top of other cargoes, provided that the total upper stow weight is not dangerously higher to present a risk of shifting, collapse and damage to the lower stow. The table also provides guidance as to which cargoes must never be loaded on top of other cargoes.

		Upper Cargo					
		Steel Plates	Reinforced Bars	Wire Rods in Coils	Steel Coils	Steel Pipes	Structural Steel Products
Lower Cargo	Steel Plates						
	Reinforced Bars						
	Wire Rods in Coils						
	Steel Coils						
	Steel Pipes						
	Structural Steel Products						

	The loading is possible.
	Special considerations are required.
	The loading is not allowed.
	Homogeneous loading and stow.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Steel plates in packaged or unpackaged form atop of:				
Reinforced Bars	Wire Rods in Coils	Steel Coils	Steel Pipes	Structural Steel Products Structural Steel Products

Steel Plates over Steel Pipes

STOWAGE

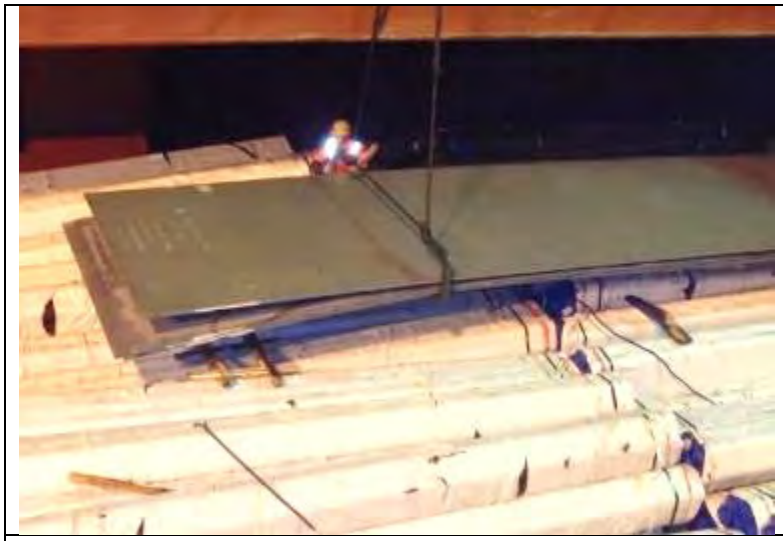
Light pipes shall not be over-stowed with steel plates as they can easily be crushed and deformed in transit. Smaller parcels of steel plates could be considered for loading over pipes. Light pipes are typically supported from inside with the use of wooden crosses, which prevents them from deformation. The lower stow of steel pipes must be loaded in a fore-and-aft direction over the full width of the cargo compartment. Where the steel pipes are of big size and not in bundles, special attention and consideration shall be made to prevent damage to the pipes as a result of the weight of the steel plates. The steel plates shall then be loaded in a fore-and-aft direction and in accordance with the relevant guidance for this cargo. When the cargo of pipes is not loaded throughout the whole length of the cargo compartment, the upper cargo of steel plates shall not extend longitudinally over the end of the pipes. Longer plates shall not be considered for loading on top of the pipes.

When handling steel plates, care shall be taken for the plates not to hog at both ends prior to stowing them over the pipes and lifting them during unloading. This will present a risk of damage to the pipes and plates' ends.

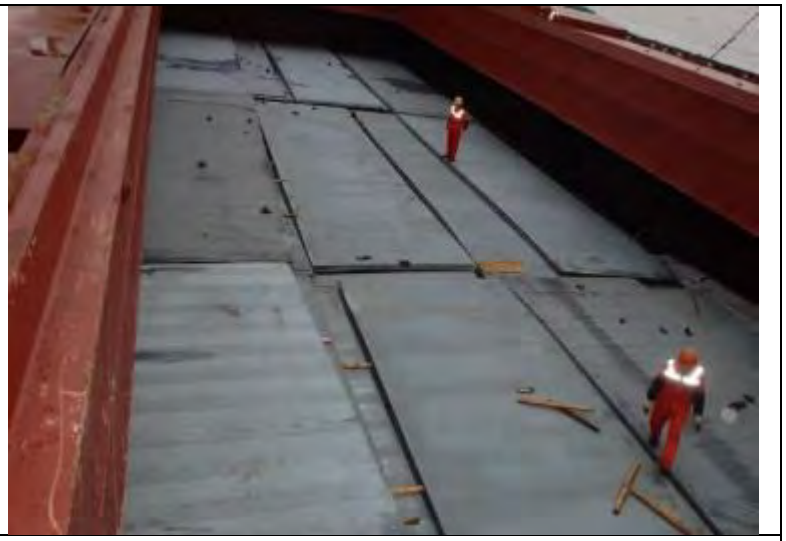
DUNNAGE

The layer of dunnage before the steel plates are loaded must be at a smaller spacing so that the pipes are protected from scratching. Ideally, spacing not exceeding 1500mm shall be considered. Upon completion of loading, there must be no direct contact between the steel plates and the pipes upon which they are stowed.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS



Prior to the loading of plates over pipes, the stow of pipes must be levelled and properly dunnaged. Insufficient dunnage. Risk of damage to the pipes and packaging.



Stow of plates loaded over a stow of pipes. The plates must be dunnaged and lashed.

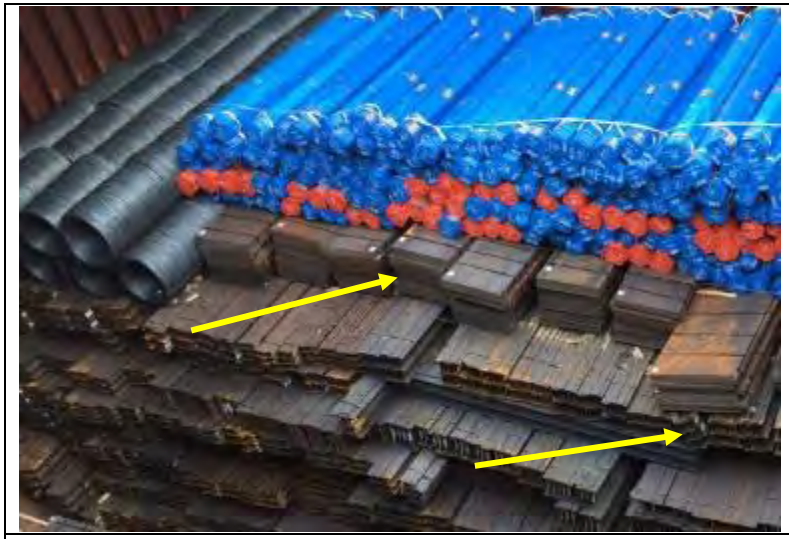
The lashing of the plates stow in progress. A stow of pipes is underneath.

Additional general cargo is loaded over the two stows of pipes and plates. The stow of plates is levelled and lashed. Dunnage is used for the general cargo units.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Steel Plates over Structural Steel Products, such as prefabricated units
Steel Plates over Structural Steel Products, such as H-beams, I-beams and other sections.

Steel plates can be considered for loading over H-beams, I-beams and other sections. It shall be born in mind that the beams and sections may be coated. Proper and sufficient dunnage and lashing materials are to be used for stow segregation and securing.

<table>
<tr>
<td>  </td>
<td></td>
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<tr>
<td>Bundled steel plates loaded over structural steel products. Structural steel products collapsed. Insufficient or no dunnage was used between the stows.</td>
<td></td>
<td>Bundled steel plates loaded over structural steel products. Incomplete top tier of steel plates. Insufficient or lack of dunnage for the top tier of plates.</td>
</tr>
</table>

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

REINFORCED BARS atop of:				
Steel Plates	Wire Rods in Coils	Steel Coils	Steel Pipes	Structural Steel Products

Reinforced Bars over Steel Plates

Ideally, the rebar and steel plates shall be stowed as a separate adjacent stows. Where this is not feasible, the stow of rebar over the plates is possible.

LASHINGS

When rebar are loaded on top of steel plates in full width and sufficient depth, no lashing may be required for the steel plates stow depending on the amount of rebar to be so loaded.

Rebar over bundled steel plates. No dunnage was used between the two stows. Dunnage is used on the side.

The rebar and steel plates are both heavy cargoes. It is strongly recommended that these are stowed horizontally apart and not one over the other.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Reinforced Bars over Steel Pipes

Rebar may be considered for loading over pipes if the pipes are not coated and in packaged form. The length of the rebar shall not exceed the pipes. The rebar and pipes must be loaded in a fore-and-aft direction.

The schematics below are indicative and for demonstration purposes only for a combined stowing of rebars over steel pipes. The sizes of the rebar's bundles are identical with the pipes' bundles. When different size of pipes are loaded under a stow of rebars, the dunnage and lashing for the stow of pipes shall be reconfigured accordingly, to provide a levelled and stable stow of pipes. Wooden wedges shall be considered for use for big diameter pipes. The dunnage between the two stows shall be at least 100mm x 100mm of softwood, provided that the stow of rebars is not significant in weight.

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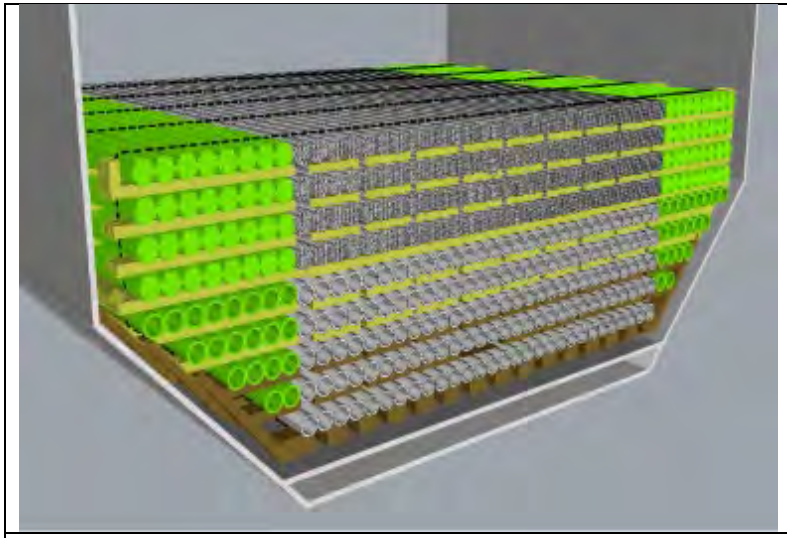
<tr>
<td>  </td>
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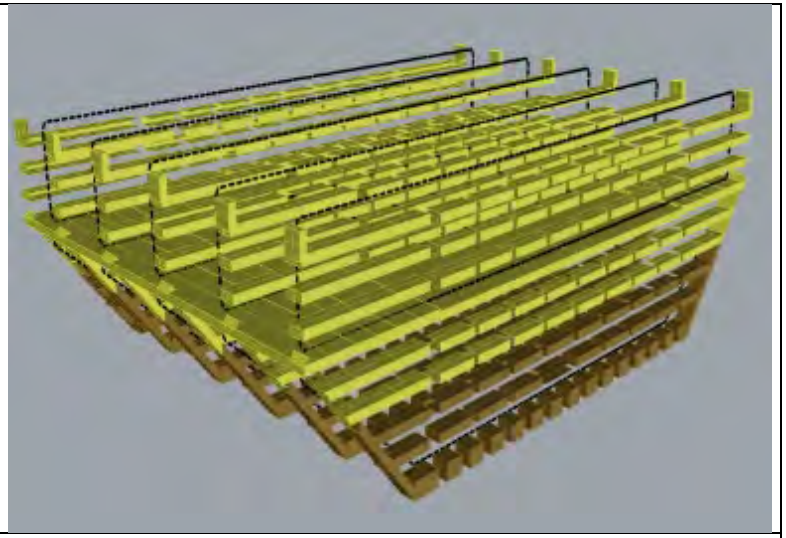
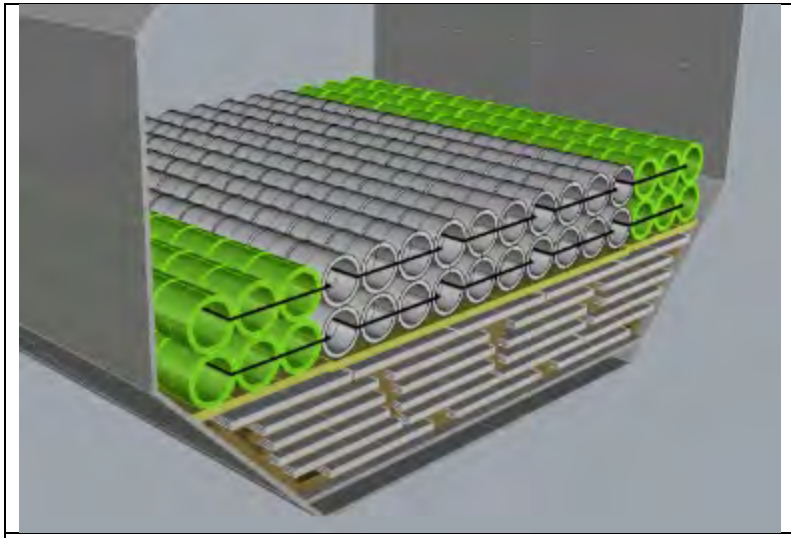
<td>  </td>
</tr>
<tr>
<td>Schematics of the stowing rebars over pipes. Hardwood dunnage for the first tiers of pipes and softwood dunnage for the subsequent tiers of pipes and rebars.</td>
<td></td>
<td>Schematics of the stowing rebars over pipes. Hardwood dunnage for the first tiers of pipes and softwood dunnage for the subsequent tiers of pipes and rebars. The two stows shall be lashed separately.</td>
</tr>
</table>

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

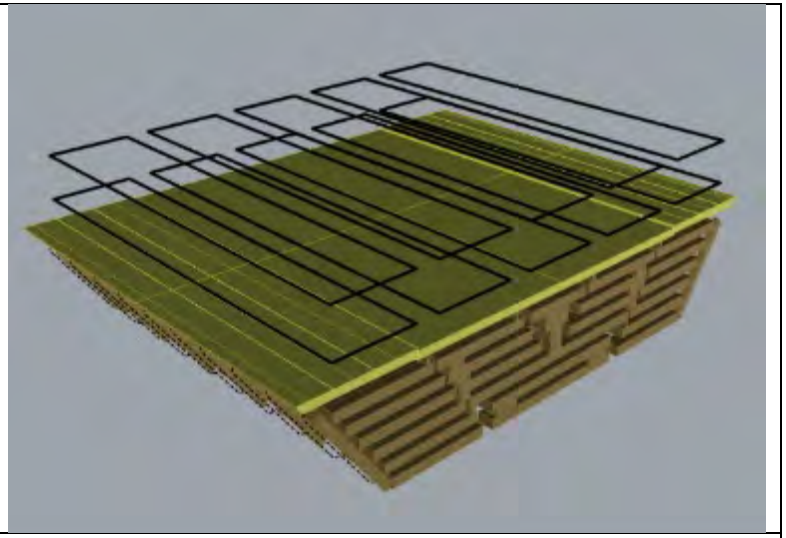
WRICs atop of:				
Steel Plates	Reinforced Bars	Steel Coils	Steel Pipes	Structural Steel Products

WRICs over Steel plates

The schematics below are indicative and for demonstration purposes only for a combined stowing of WRICs over steel plates. The dunnage between the two stows shall be of plywood sheets to protect the plates and their coating, in the event of bundled and packaged plates being stowed underneath the WRICs.



WRICs loaded over steel plates. Plywood dunnage shall be placed on top of the steel plates stow. The plates shall be lashed, if not off-loaded at the same port as the WRICs. The WRICs stow shall be lashed separately.



Schematics of the dunnage and lashing approach for the two stows.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

WRICs over Rebar

Warning: Because of the nature of the rebar, the stow may shift or settle and the lashing may become loose. Loading of WRICs on top would require additional lashing for a firm stow of WRICs to be formed.

LASHINGS

For higher stows of WRICs, for the first tier on top of the rebar, the four adjacent coils in athwartships and longitudinal directions shall be lashed together. This will prevent shifting and collapse of the WRICs stow during the voyage, in the event of settling of the rebar.

UNDER-COAMING STOWAGE

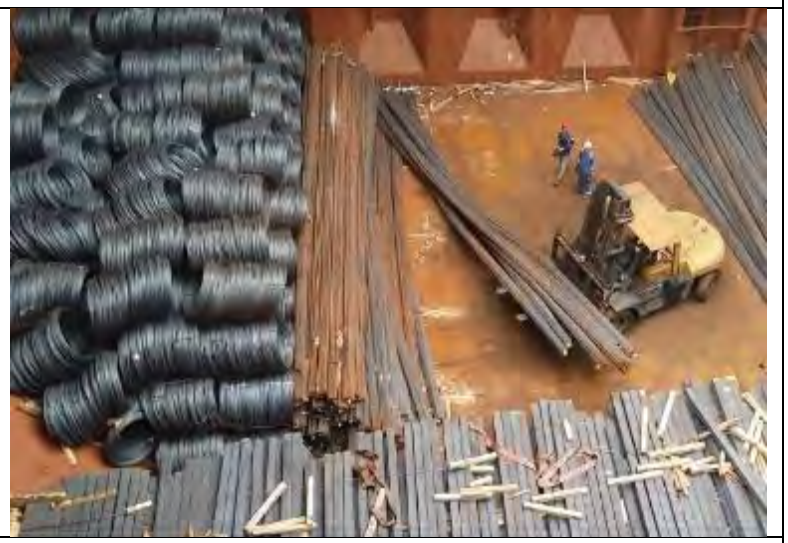
Where a forklift truck is to be used for the off-loading of WRICs, working steel plate platforms shall be used for the forklift truck to be used on top of WRIC and/or rebar tiers.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Plastic sheets used to segregate the rebar from the WRICs.

It is important to level the rebar stow prior to the loading of WRICs atop.

Discharging of WRICs. The dunnage used to segregate the two stows is noted to have been crushed. It is recommendable to lash the first rows of WRICs together prior to the loading of the subsequent tiers.



WRICs loaded athwartships under the coaming with adjacent rebar in the open hatch area. Lack of dunnage and lashing. Improper stow for the WRICs and rebar.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

WRICs over Steel Coils

STOWAGE

Warning: WRICs shall not be stowed over CRCs because of the risk of damage to the packaging and the cargo. WRICs may be stowed on top of HRCs only.

The lower stow of HRCs must be loaded in accordance with the relevant guidance and over the full width of the cargo compartment. Generally, the HRCs have a low stowage factor and may contain heavy units of up to 30 tonnes. Ideally, the HRCs shall be in one tier with one or two locking coils. WRICs may be loaded as a second, third and more tiers, provided that the structural integrity of the tank-top is not exceeded.

LASHINGS

The first tier of WRICs may be lashed to the HRCs units using steel band straps.

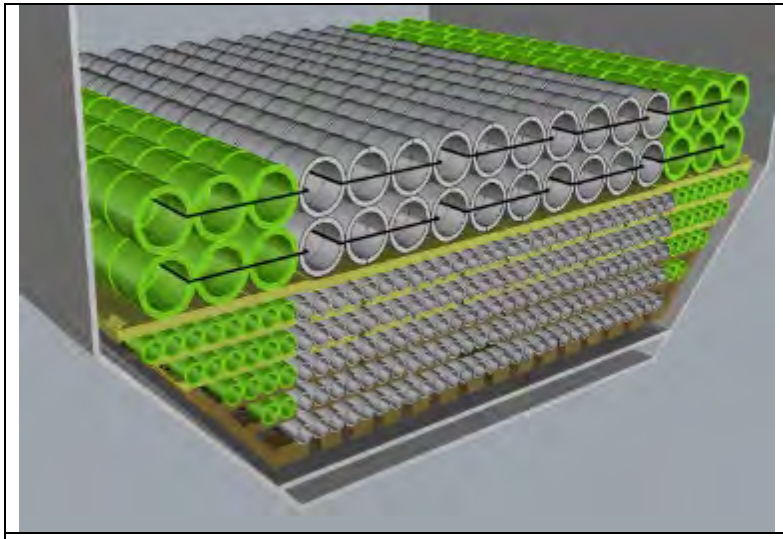
WRICs are normally loaded in the cantlines of the coils. The subsequent tiers of WRICs shall follow the same pattern. Proper WRICs lashing will be required.

The under-coaming stow of WRICs will be impossible to access with a vertical plumb of the crane. A forklift truck to provide access to the WRICs cannot be utilised.

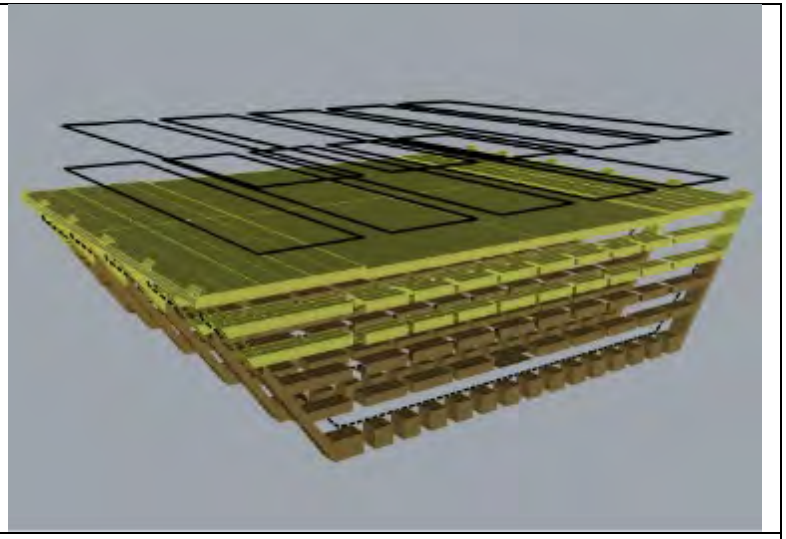
COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

WRICs over Steel Pipes

The schematics below are indicative and for demonstration purposes only for a combined stowing of WRICs over steel pipes. When different size of pipes are loaded under a stow of WRICs, the dunnage and lashing for the stow of pipes shall be reconfigured accordingly, to provide a levelled and stable stow of pipes. Wooden wedges shall be considered for use for big diameter pipes. The dunnage between the two stows shall be of plywood sheets to protect the pipes and their coating.



WRICs loaded over steel pipes. Plywood dunnage shall be placed on top of the steel pipes stow. The two stows shall be lashed separately. ✓



✓ Schematics of the dunnage and lashing approach for the two stows.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

WRICs over Structural Steel Products

Insufficient dunnaging and lashing of the WRICs stow over the structural steel stow.

Insufficient dunnaging and lashing of the WRICs stow over the structural steel stow.

WRICs over structural steel products over steel plates. The WRICs shall be properly stowed, dunnaged and lashed when loaded in the under-coaming area.

Off-loading of WRICs, stowed over structural steel products.

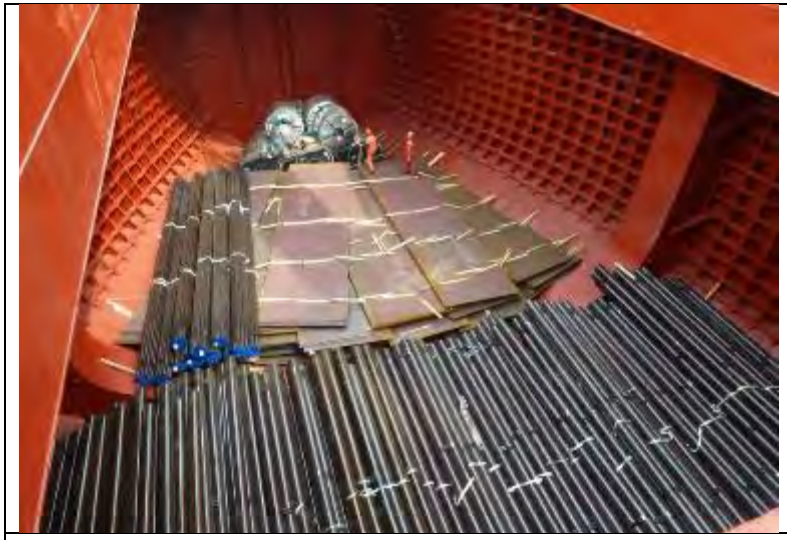
COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

STEEL PIPES atop of:				
Steel Plates	Reinforced Bars	Wire Rods in Coils	Steel Coils	Structural Steel Products

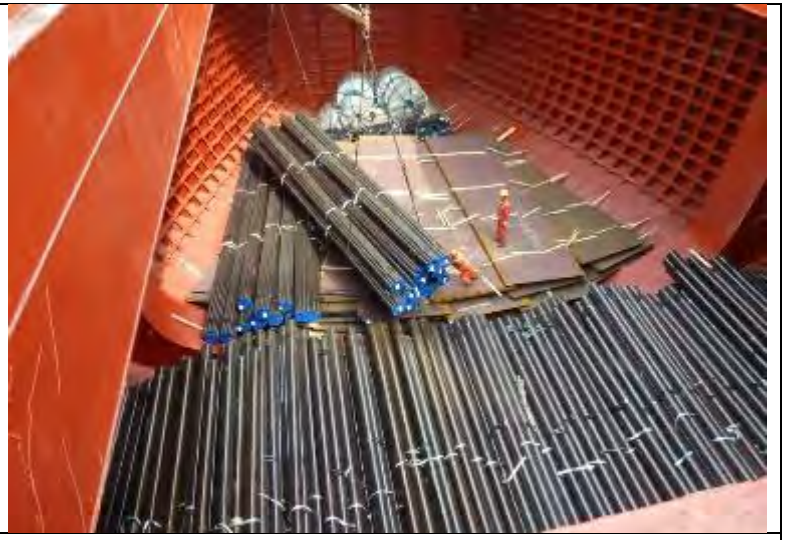
Steel Pipes over Steel Plates

DUNNAGE

For large-diameter unbundled pipes, dunnage may not be required between the tiers. Dunnage is required to be used for small-diameter pipes in bundles.

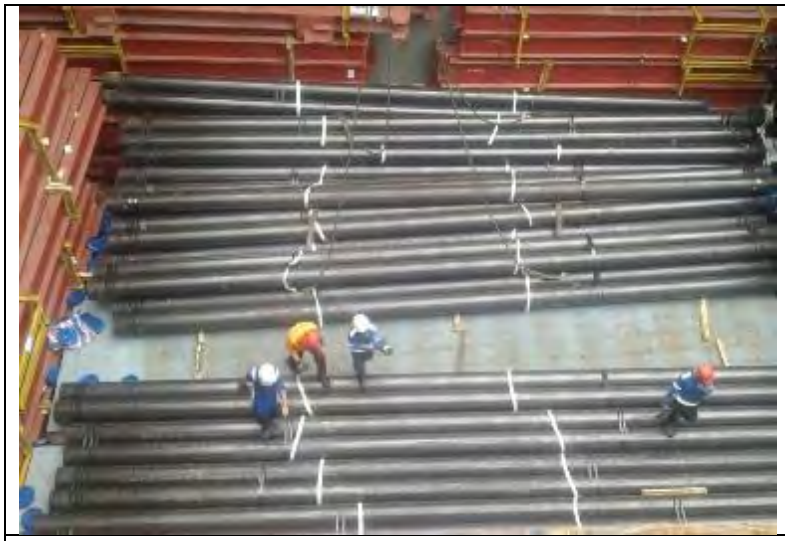


The plates must be level. Dunnage must be used between the two stows. Nylon web lashing must be laid before the pipes are loaded.



The pipes shall be pre-slung for ease of off-loading. Proper stool dunnage between the pipes and the side bulkheads must be used.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS



Pre-slung and bundled pipes loaded on top of steel plates.

Bundled pipes in packages loaded over bundled steel plates, loaded over structural steel. The pipes are staggered from the face of the stow. No dunnage was used. The three stows are lashed individually.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Steel Pipes over Rebar

Various sizes of pipes. The pipes are pre-slung. No dunnage in use between the rebar tiers. The rebar stow is not level. Pipes loaded without dunnage.

Pipes loaded over steel plates. Similar dunnage arrangement shall be adopted when pipes are loaded over rebar.

Pipes loaded longitudinally over an athwartships stow of rebar. This arrangement requires a lot of dunnage to separate the stows and to make the rebar stow levelled.

The dunnage in use is not sufficient. It will sink in between the rebar' bundles.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Steel Pipes over Steel Coils

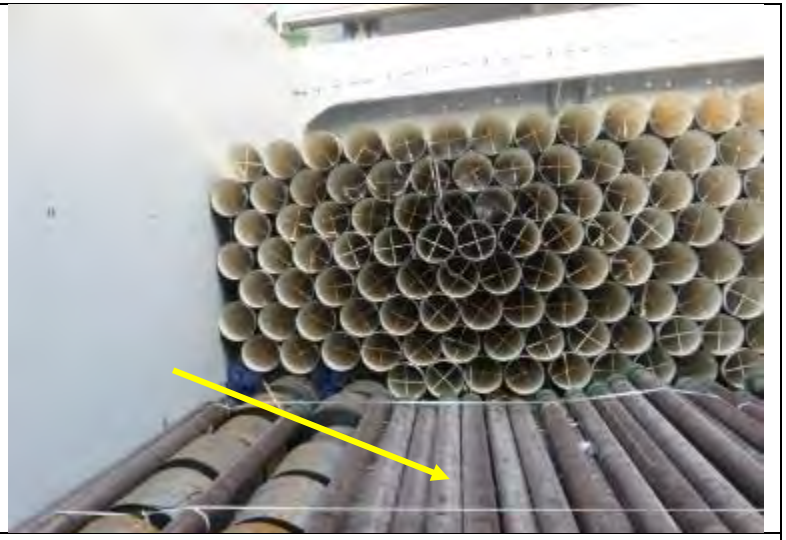
STOWAGE

Stowage of pipe over CRCs shall not be considered. Stowage of pipe over HRCs can be considered, providing the tank top is not overloaded. The lower stow of HRCs must be loaded in a fore-and-aft direction and over the full width of the cargo compartment.

Because of the size and shape of the coils, the stow cannot be levelled in preparation for an over stow of pipes. Usually, large diameter pipes will be stowed in the cantlines of the coils, until a levelled stow is formed for subsequent tiers of pipes/bundles. Dunnage used will depend on the size and weight of the pipe. Pipe bundles shall be either pre-slung, without dunnage, or with dunnage between the tiers, if not pre-slung.

Light-weight pipes loaded over HRCs in a lower stow. The vessel does not have side under-coaming areas. ✓

Heavy steel pipes shall not normally be loaded on top of heavy steel coils.



✓ Heavier pipes loaded over HRCs in fewer tiers only. The vessel does not have side under-coaming areas.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Steel pipes shall not normally be loaded on top of heavy steel coils.

Pipes loaded over HRCs. This creates a high risk of overloading the tank-top and human injury. No dunnage is used.

Pipes loaded over HRCs. Risk of overloading the tank-top. Dunnage is not sufficient and is collapsing in the cantlines.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Steel Pipes over Structural Steel Products

The lower stow of structural steel products (steel sections, H-beams, etc., not prefabricated units) must be loaded in a fore-and-aft direction and in accordance with the relevant guidelines and over the full width of the cargo compartment.

Pipes may be loaded over some structural steel, such as H-beam, I-beam. In this photograph, the H-beams are also loaded on top of steel plates.

Pipes loaded over structural steel cargo in a box-shape cargo hold.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Pipes loaded over structural steel products. Some of the pipes are too close to the adjacent stow of rebar and there is a risk of damage in the event of shifting and discharging.

Pipes in packages loaded over structural steel. Lashing has been removed. No dunnage to level the first tier of pipes was used. The bundles are pre-slung.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

STRUCTURAL STEEL PRODUCTS atop of:				
Steel Plates	Reinforced Bars	Wire Rods in Coils	Steel Coils	Steel Pipes

Structural Steel Products over Steel Plates

Loading of palletised structural steel over steel plates. The stow of plates is properly levelled.

Dunnage and lashing properly prepared for the stow of structural steel products.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Various general cargo products loaded over steel plates. The stow of steel plates is properly levelled.

General cargo stowed over steel plates. This stowage requires proper lashing, securing and dunnaging.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Structural Steel Products over Rebar

Lack of dunnage. The stow of rebar is not levelled.

Lack of dunnage. Dunnage shall be positioned under the container corner posts, not the bottom side rail.

Loading of various general cargo pallets over rebar. The rebar stow is not even and properly levelled.

Containers loaded over a well-levelled stow of rebar. The containers must be lashed in a uniform block of stow.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS

Structural Steel Products over Steel Pipes

DUNNAGE

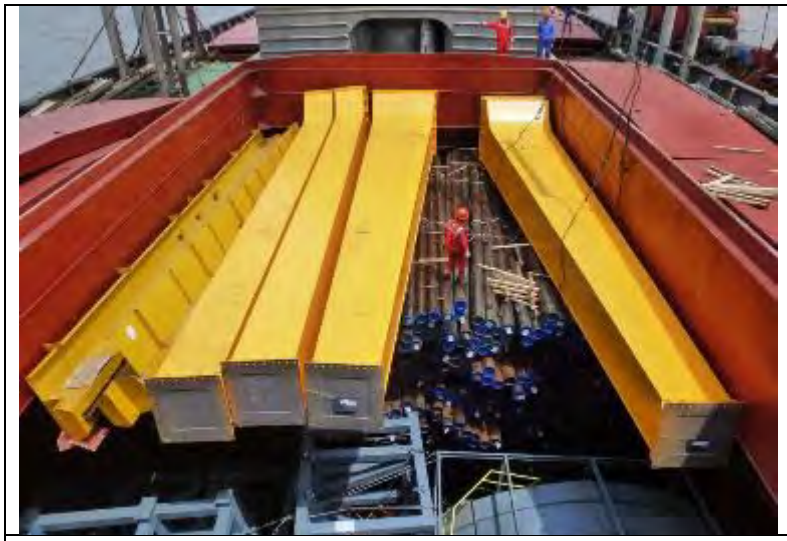
The layer of dunnage between the two stows must be at a smaller spacing so that the pipes are protected from scratching and deformation. Ideally, spacing not exceeding 1500mm shall be considered to ensure there is no direct contact with the pipes.

The upper tier of structural steel products shall be properly dunnaged vertically and horizontally to prevent the cargo from shifting.

Bundled palletised steel cargo loaded over pipes. Proper use of dunnage. No lashing preparation for the stow above the pipes. Proper use of lashing for the pipes.

Loading of general cargo units over pipes. The cargo unit must be lashed. Proper use of dunnage.

COMBINED STOWAGE OF DIFFERENT STEEL PRODUCTS



Loading of general cargo units over pipes. Proper dunnage and protection must be used to prevent damage to the pipes and to support the overhanging end of the prefabricated units. Their weight must be verified.

Various project cargoes may be loaded over pipes. Proper dunnage to level the stow is required. The stow of pipes must also be levelled.