

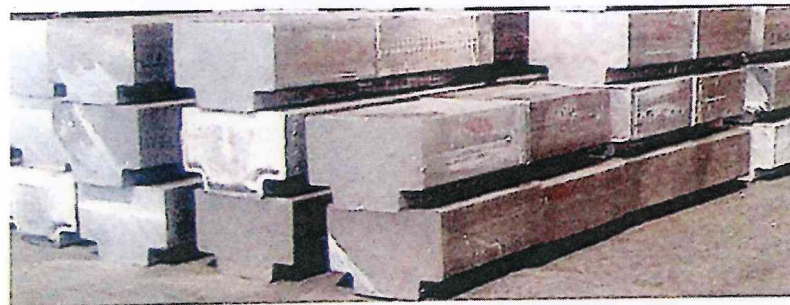
Ingots, Billets, Blooms, Slabs

General

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

Ingots are generally very heavy and vary in weight and profile. The smaller ingots weigh between 12 kg and 15 kg (small ingots), mid-weight ingots are above 20 kg and T-ingots generally weigh between 500 kg and 820 kg, and sometimes more. Lighter and medium-weight ingots are usually tightly bundled or palletised into a unit weight of approximately 1 tonne, while T-ingots are handled individually. Bundling is usually made of high-tensile metal strapping or high-strength polyester strapping in a vertical pattern of 2 + 1 straps per one bundle of ingots.

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



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



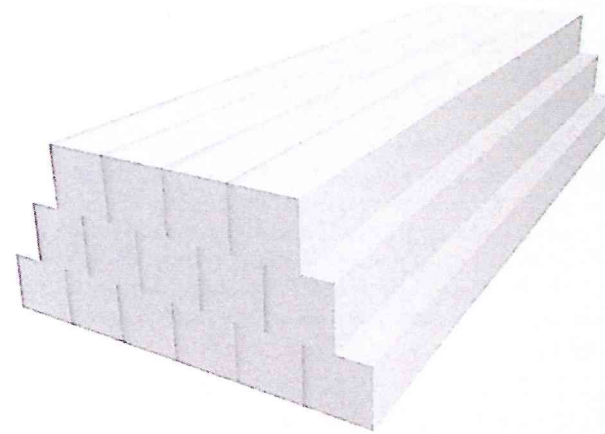
Medium-weight aluminium ingots stored in the open

Ingots, Billets, Blooms, Slabs

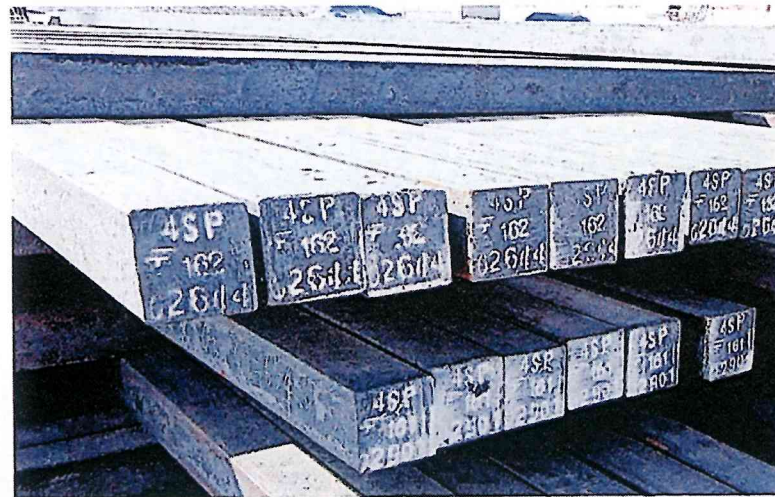
Billets are normally shipped as unwrapped and unprotected cargo units. Their usual size is about 150 mm × 150 mm and they can be up to 12 metres long. A single billet may weigh up to 1 tonne. The billets may be bundled with the use of wire rod, forming heavy units with a small stowage factor.

Blooms may be of square or circular cross-section. These are also shipped unwrapped and unprotected. The usual size is 230 mm × 230 mm. A single bloom may weigh up to 2.5 tonnes and be up to 6 metres in length, and should be handled with care. Circular aluminium 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 19 mm wide and 1 tonne breaking strength.

Slabs are usually made to a predetermined specification. The unit size is typically 250 mm thick and 2,500 mm wide. The length varies and a unit weight may reach 20 tonnes. Slabs are not bundled.



Square blooms



Billets



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 on top of 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 best practice, good, dry, hardwood dunnage should be used throughout, as soft wood dunnage is too easily crushed or damaged. Rounded timber, timber with damaged or crushed corners, or non-square face dunnage must not be used. Only square one-layer dunnage should be used. Double-stacked, rectangular dunnage or 1 on 2 stack dunnage arrangements must not be used.

Dunnage should be laid in rows on the tank-top in an athwartships direction under each row of pallets. Plywood sheets of minimum 25 mm thickness are to be used, with length dependent on the cargo dimensions. Dunnage should be placed between individual tiers. Wooden chocks should also be placed between the units and bundles/packages on every tier. The cargo is generally heavy and, therefore, care should 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, the preference is for them to 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 should be applied. Similar dunnage should be placed against the inner shell plating and bulkheads and the internal vertical frames. The higher or heavier the intended stow, the more dunnage should 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. 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 should be used to protect the bulkheads and frames. If the stow is not tight, dunnage chocking should be applied where necessary to avoid loose bundles and prevent shifting.

For the loading of billets, blooms and slabs, plywood dunnage sheets should not be used. For bulk carriers, dunnage should be placed on the hopper tanks and should be sufficient to provide effective protection for the ship and cargo in the event of heavy weather on voyage. The length of the dunnage should be sufficient to provide good overlapping for slabs, but small-length dunnage may be used if properly aligned.



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

Ingots, Billets, Blooms, Slabs

Lashings

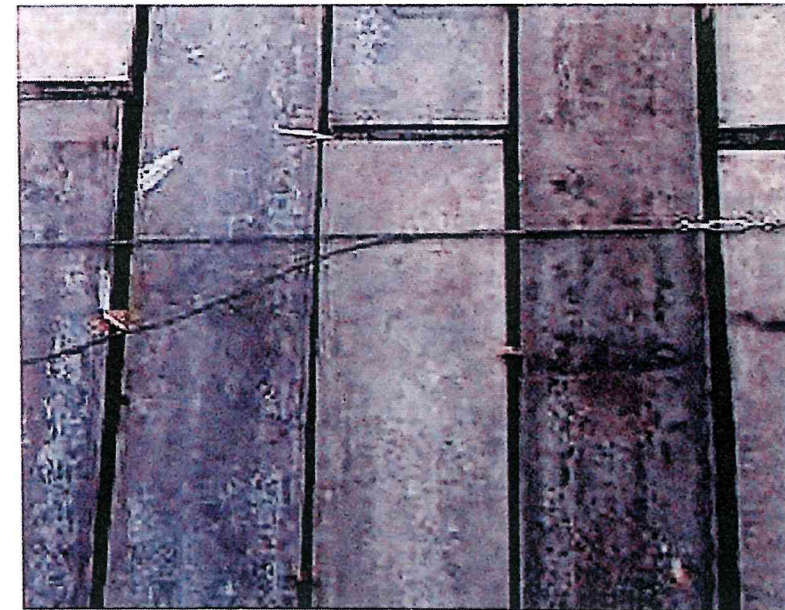
When a cargo of ingots is stowed across the full width of the cargo hold, the stow is prevented from shifting by the friction resistance of the timber dunnage used and the chocking timber dunnage used to block the top tier. Wire or chain lashings may not be used for a stow of ingots if loaded throughout 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 should be tight and well made. The Master should be supplied with certificates for all the lashing equipment used.

An appropriate number of lashing wires or chains should be laid in an athwartships direction on the tank-top in preparation for being passed back over the stow to secure the cargo in one block. Metal straps are not recommended to be used for lashing, particularly for heavier units. Because of their weight, the dunnage tends to compress and loosen the stow of ingots (UK P&I Club *'Carefully to Carry'*).



✘ Incorrect use of bulldog grips



✘ Incorrect use of bulldog grips, with grips on the live wire. Insufficient number of grips used

Ingots, Billets, Blooms, Slabs

Stowage

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 structures should 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 should 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 should be evenly distributed throughout the cargo compartment. Overhung first-tier cargo units (slabs) should 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 should 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 ship was built. It should be remembered that this limit was calculated when the ship was new. For older ships, with normal wear and tear on the tank-top plating and associated under-deck stiffening, it is prudent to allow a safety margin.

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

Any timber structures built to support the stow should 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 should be chocked with timber dunnage to provide a secure, tight and level stow across the full width of the cargo hold.

California block stowage should be avoided for the loading of slabs. In general, slabs are loaded similarly to steel plates, and the tiers should 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



✓ Unbundled T-ingots delivered in port



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



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

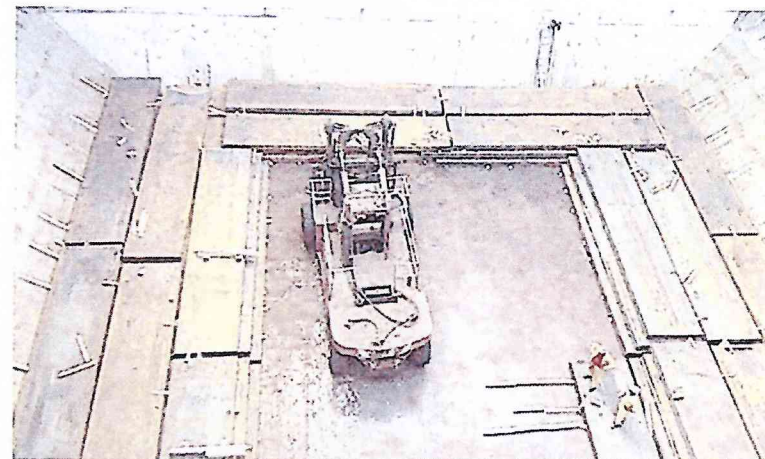


✓ Billets stored at the quay, ready for loading

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 should be used on the tank-top. The spacing should be a maximum of 2 metres

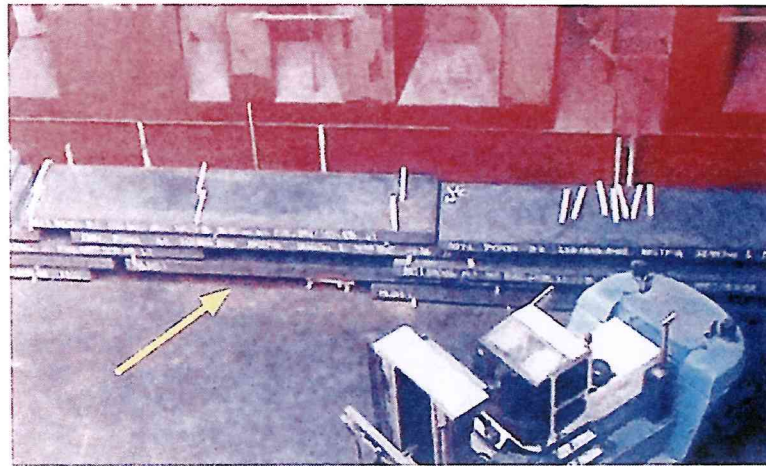


✓ An athwartships stow of slabs. Proper use of dunnage

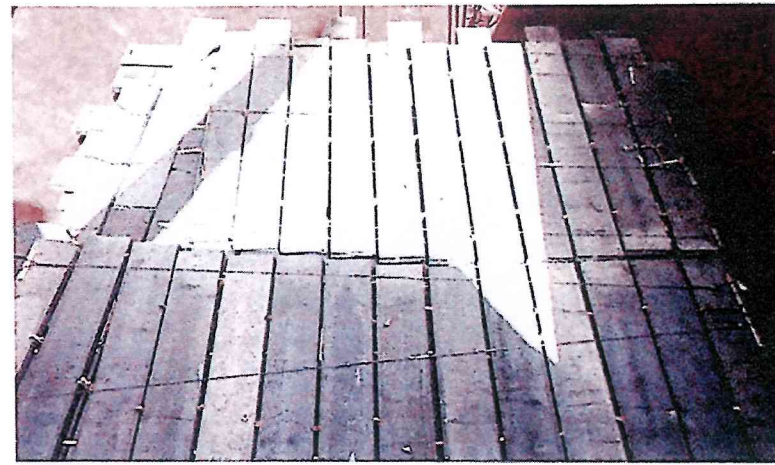


✓ A fore-and-aft loading of slabs. Proper use of dunnage

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 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

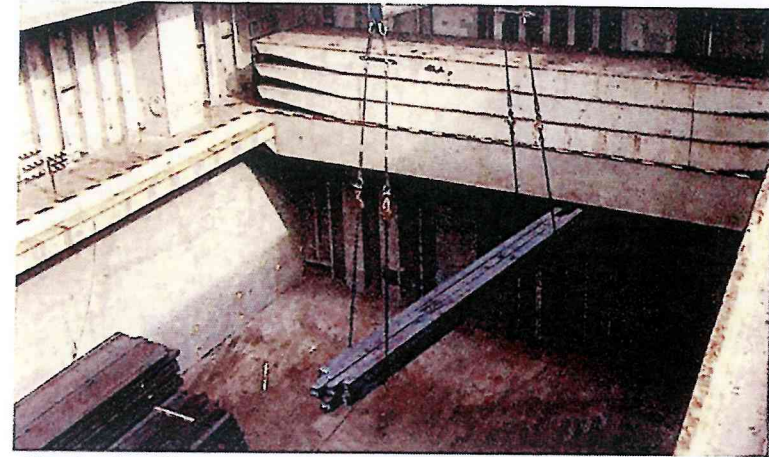


✔ A properly chocked full stow of slabs in a box-type cargo compartment. This stow does not need wire lashing

Ingots, Billets, Blooms, Slabs



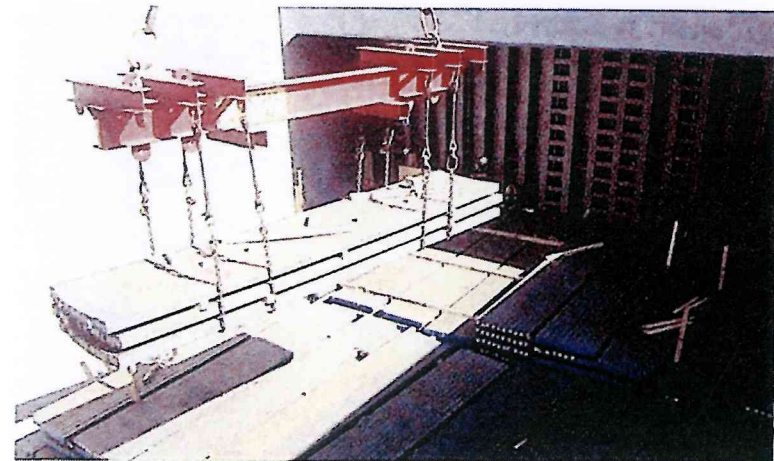
✓ Loading of billets in a box-type cargo compartment. Hardwood dunnage is laid on the tank-top. The spacing does not exceed 1.5 metres. Lashing is prepared



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

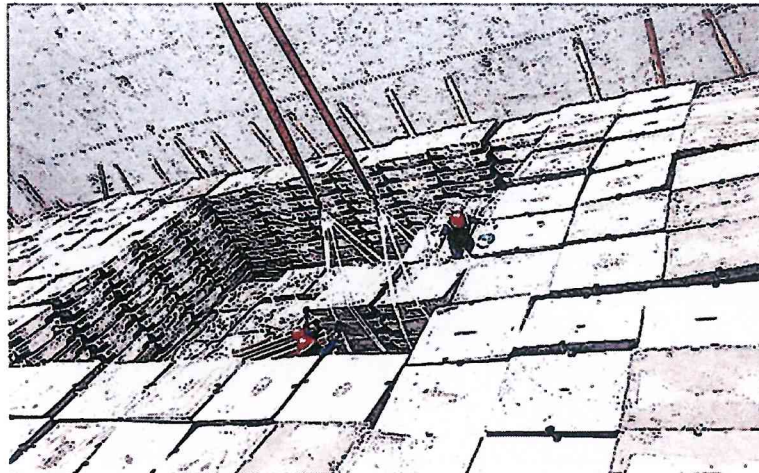


✓ Dunnage is used between each tier of billets to ensure level tiers and ease of handling with a forklift truck during discharging

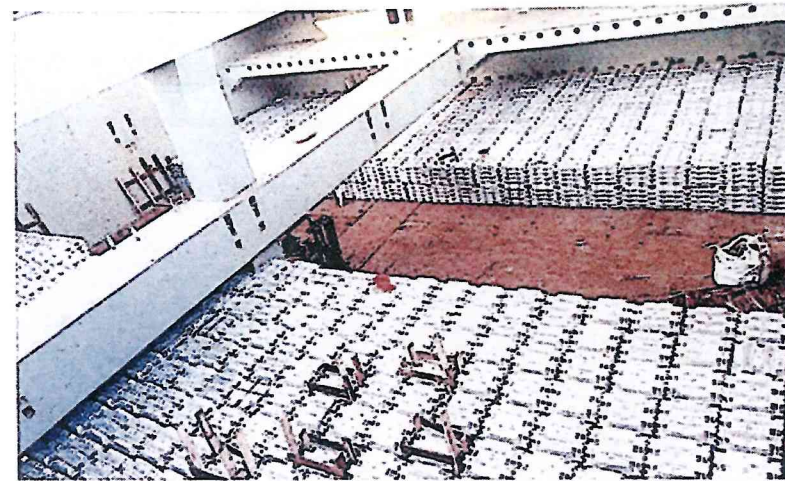


✓ Loading billets with a spreader and chain slings. Square hardwood dunnage should be used for each tier of billets

Ingots, Billets, Blooms, Slabs



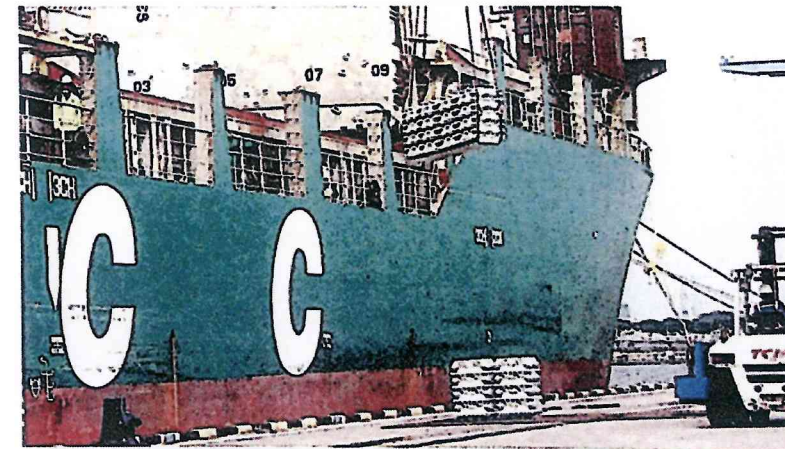
✓ Handling of small-size aluminium ingots. Dunnage should be used for gaps



✓ Good compact stow for ingots with proper bulkhead protection in place



✓ Discharging small-size palletised ingots with the use of a forklift truck



✓ Loading of ingots at Jurong Port

Ingots, Billets, Blooms, Slabs



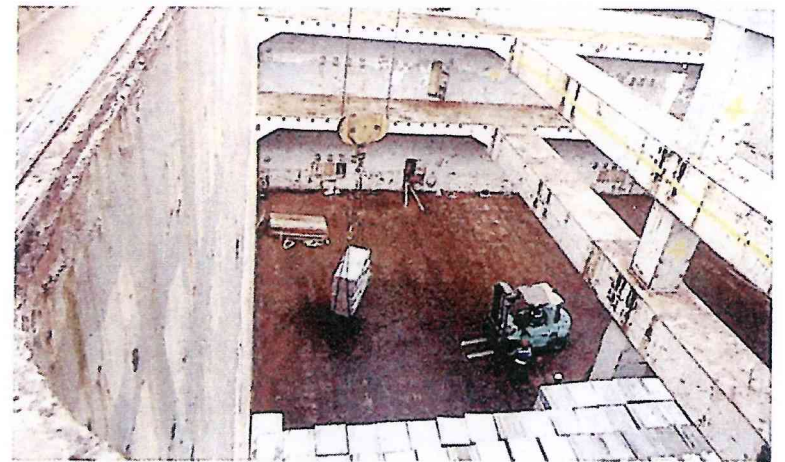
✓ Handling pre-slung, bundled, medium-size ingots



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

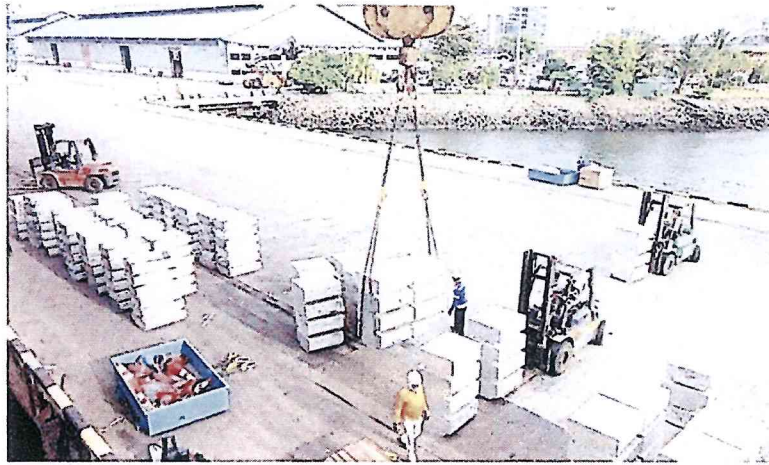


✓ Handling pre-slung, bundled, medium-size ingots. Loading on a trailer for further storage in a warehouse



✓ T-ingots handled with chain slings

Ingots, Billets, Blooms, Slabs



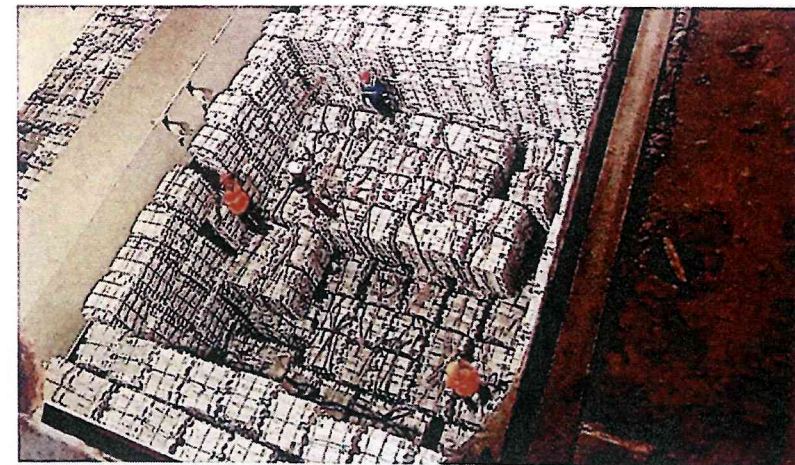
✓ Handling of unbundled heavy T-ingots with the use of a chain sling



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



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

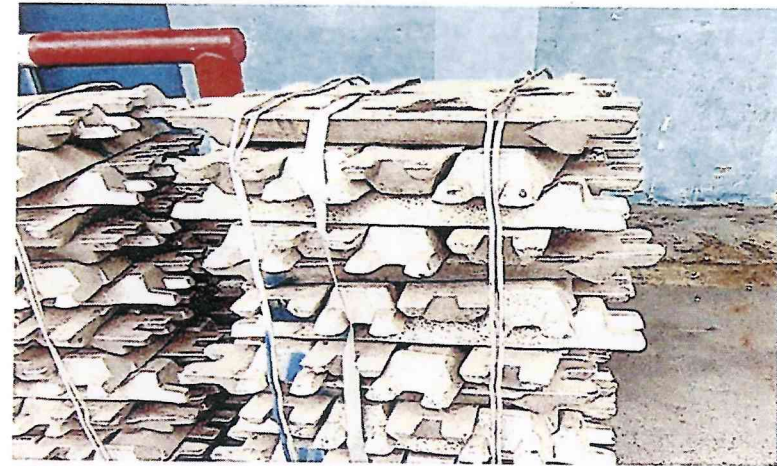


✓ Preparation of chain slings for discharging of ingot bundles

Ingots, Billets, Blooms, Slabs



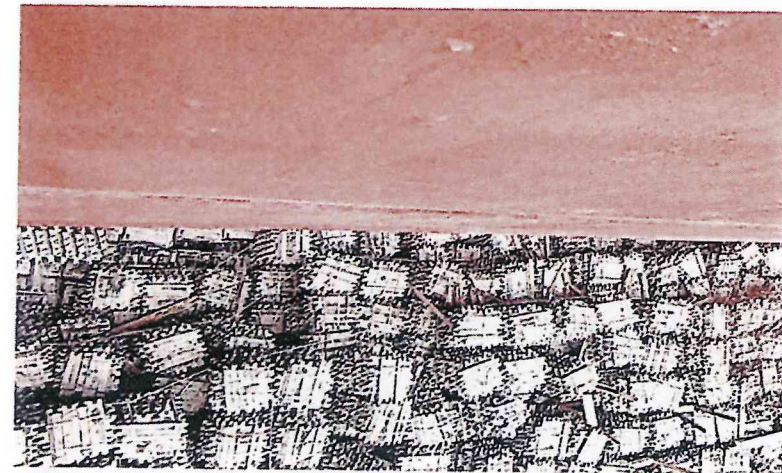
✓ Use of forklift trucks for discharging bundled ingots and T-ingots from a box-type cargo compartment



✗ Non-uniform bundling in place. Loose bundling makes handling the ingots more onerous and riskier



✗ Poor stowage. Cargo stow is not levelled



✗ No proper chocking to fill the gaps

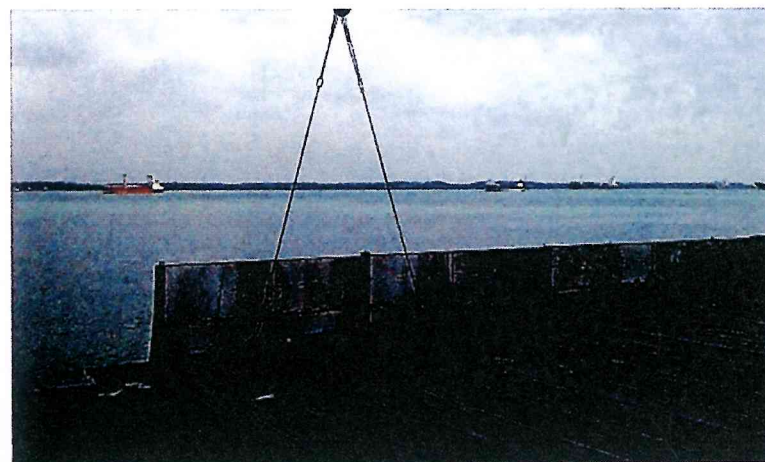
Ingots, Billets, Blooms, Slabs



✘ Improper bundling. Ingot bundles loose in the warehouse



✔ Transportation of T-ingots to warehouse



✔ Discharging billets with the use of a choke hitch

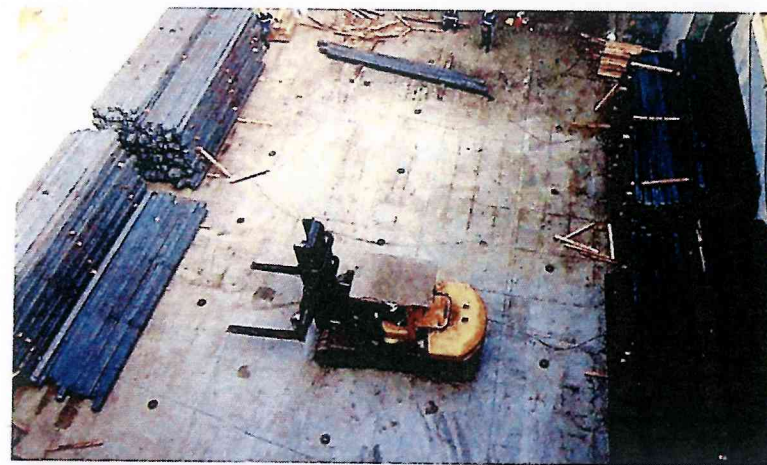


✔ Discharging and handling of blooms

Ingots, Billets, Blooms, Slabs



✓ Discharging blooms with the use of a single chain-leg basket lift under a spreader



✓ Handling of blooms inside the cargo compartment in preparation for discharging



✓ Blooms discharged ashore



✓ Blooms discharged ashore

Ingots, Billets, Blooms, Slabs

Notes

- The tank-top load limits are not to be exceeded. Consideration should be given to the hopper areas, where the load limits may be smaller.
- The tank-top should be prepared with appropriate hardwood dunnage to prevent the billets, blooms and slabs from shifting. The size of the dunnage should, as a minimum, be 150 mm x 150 mm. The spacing of the dunnage should not exceed 1.5 metres, depending on the length of the steel product.
- Plywood sheets of dunnage should be used for the loading of T-ingots and for ingots in bundles and pallets on the tank-top and between the subsequent tiers. Wooden planks of size 200 mm x 20 mm may also be used between the tiers of bundled ingots.
- Soft wood dunnage may be used between the bulkheads/frames and the stow instead. The dunnage construction should be such that it will assist the stow to remain vertical during the voyage.
- Lashing wires, spaced no more than 3 metres apart, should 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 should be applied.
- All tiers of ingots, billets, blooms and slabs should be stowed level.
- In the cargo compartments, where possible, safe passage should be provided directly from the ladders to the top of the cargo stow. In bulk carriers, this access should be provided directly from the Australian ladders. Safe access should also be provided from the tank-top to the top of the cargo stow.

Combined Stowage of Different Steel Products

General

Mixed loading of different steel cargoes in one cargo compartment should always be subject to proper planning, correct stowage, securing, dunnaging and lashing. Generally, where the cargo parcels cannot be segregated horizontally, vertical segregation may 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 should 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 rod 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 relevant cargoes should be adhered to.

Dunnage

When loading a combined stow of various steel cargoes, dunnage is 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 ship'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.

In accordance with industry best practice, good, dry, bark-free dunnage should always be used. Hardwood dunnage is to be placed on the tank-top as soft wood dunnage is too easily crushed or damaged. The dunnage used for the lower stow should 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 should be considered for use throughout the lower stow. Soft wood dunnage may be used for the upper areas of the stow, depending on the weight it will have to bear.

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

There should be sufficient dunnage between two stows of different types of steel cargo. Generally, square hardwood dunnage of 100 mm x 100 mm size should be used. Since combined stows would normally be loaded in a fore-and-aft orientation, dunnage would lay in an athwartships direction. The purpose of the dunnage is to ensure the first stow is levelled and ready for loading of the upper stow. The dunnage for the upper stow should 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. This is particularly relevant for hopper-type cargo holds, where 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 should be used to lock the coils and pipes in position. Wooden wedges should also be considered between the tiers of pipes.

Dunnage structures should be built underneath overhanging parcels that are stowed on top of shorter parcels. This is particularly necessary when structural steel products and prefabricated units are loaded over other steel cargo types.

Plywood dunnage sheets are used for loading and stowing of WRIC. Where this cargo is loaded on top of steel coils or large diameter pipes, plywood may also

Combined Stowage of Different Steel Products

be necessary to prevent damage to any coatings on the coils or pipes. If the WRIC are loaded into the cantlines of HRC, dunnage may not be required.

Lashings

When loading combined stows of various types of steel, lashing is required 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 ship's structures and cargoes from damage
- to segregate the individual parcels from one another
- other reasons, as may be deemed necessary.

When two different steel products are loaded as a combined vertical stow, lashing is generally in accordance with the guidelines for loading a homogeneous cargo of the same type. The two stows should be lashed individually. This is particularly important when the lower stow is not discharged 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 ship from that discharging port.

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

Copies of all certificates for the lashing materials are to be requested and presented to the Master prior to the ship's departure. For details of the lashing and the materials used, reference should 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 discharging. The bundles and slings should be certified. Details of the bundling are provided in the relevant guidelines for the homogeneous stows of steel cargoes and should be referred to.

Stowage

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

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

The requirements of the CSS Code and the ship's cargo securing manual should always be complied with.

If the lower stow comprises parcels of rebar, pipes or structural steel products, these should 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 WRIC 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, should be stowed longitudinally in the coils' cantlines.

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

To avoid overhangs, wherever possible longer steel units should not be loaded on top of shorter products. If this is unavoidable, dunnage (or other) support of the overhang should 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 should be supported.

Combined Stowage of Different Steel Products

If the upper stow does not 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, should ideally be horizontally segregated, such as in the fore-and-aft direction. Where this is possible, each parcel should 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 metre should then be allowed between each of the longitudinal stows. Where, for any reason, there are two or more transversely adjacent stows, no minimum clearance between the parcels is required. One cargo type should 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 manoeuvrability for the truck.

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

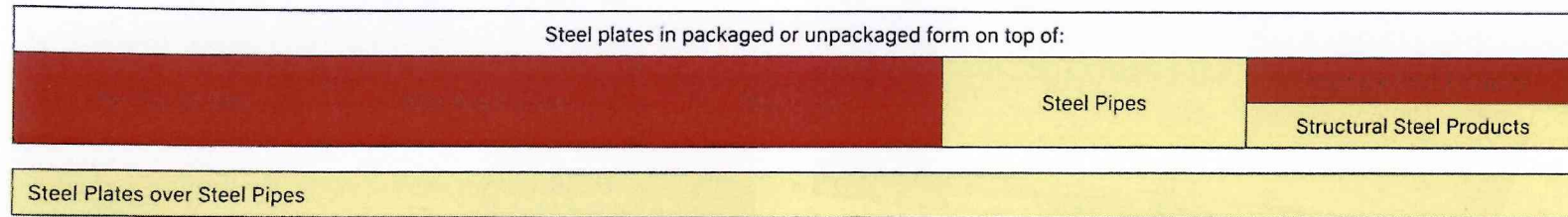
Under-coaming cargoes must be pre-slung where possible, particularly for rebar, pipes and structural steel products.

Combined Stowage of Different Steel Products

The table 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 Rod in Coils (WRIC)	Steel Coils	Steel Pipes	Structural Steel Products
Lower Cargo	Steel Plates		Light Green	Light Green	Red	Light Green	Light Green
	Reinforced Bars	Red		Yellow	Red	Light Green	Yellow
	Wire Rod in Coils (WRIC)	Red	Red		Red	Red	Red
	Steel Coils	Red	Red	Yellow		Yellow	Red
	Steel Pipes	Yellow	Yellow	Light Green	Red		Yellow
	Structural Steel Products	Red	Red	Yellow	Red	Yellow	
		Light Green					
		Yellow					
		Red					
		White					
		Loading is possible.					
		Special considerations are required.					
		Loading is not allowed.					
		Homogeneous loading and stow.					

Combined Stowage of Different Steel Products



Stowage

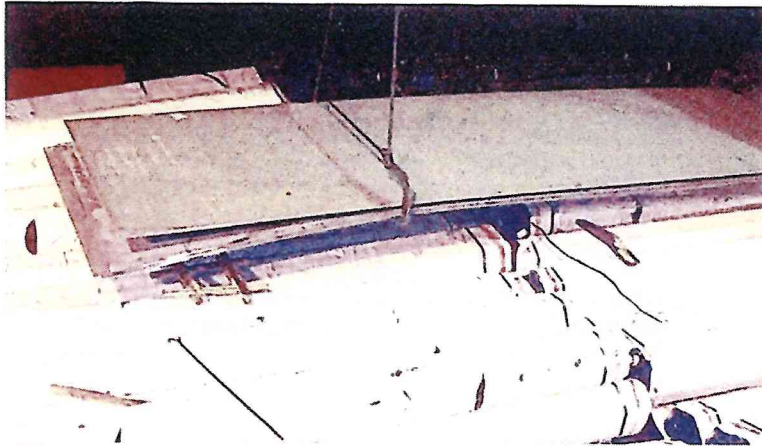
Light pipes must not be over stowed with steel plates as they can easily be crushed and deformed in transit. Smaller parcels of steel plates could be considered for loading over pipes. Light pipes are typically supported from inside with the use of wooden crosses, which prevents them deforming. The lower 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 large size and not in bundles, special attention and consideration must be given to preventing damage to the pipes as a result of the weight of the steel plates. The steel plates should 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 should not extend longitudinally over the end of the pipes. Longer plates should not be considered for loading on top of the pipes.

When handling steel plates, care should be taken to avoid hogging of the ends of the plates prior to stowing them over the pipes and when lifting them during unloading. This will present a risk of damage to the pipes and to the plates' ends.

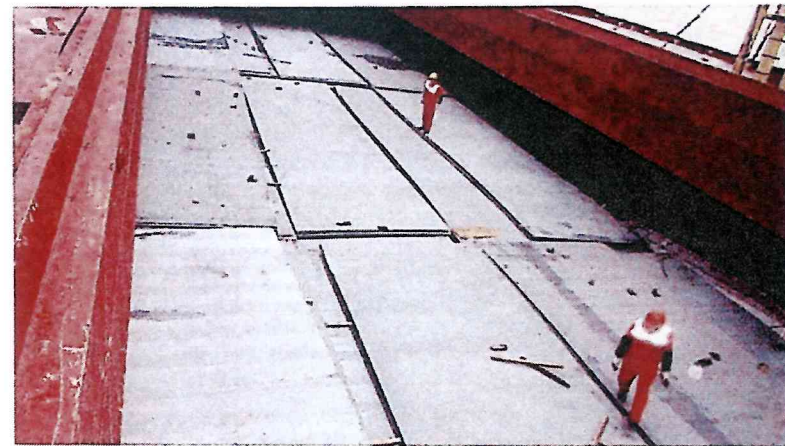
Dunnage

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 1,500 mm should be considered. Upon completion of loading, there must be no direct contact between the steel plates and the pipes upon which they are stowed.

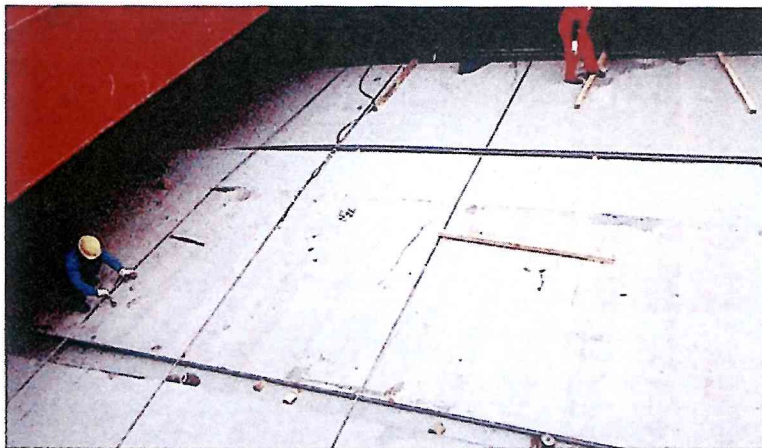
Combined Stowage of Different Steel Products



✘ Prior to loading 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



✔ Lashing of a stow of plates 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 Storage of Different Steel Products

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 should be borne 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.



✘ Bundled steel plates loaded over structural steel products. Structural steel products have collapsed. Insufficient or no dunnage was used between the stows



✘ 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

Combined Stowage of Different Steel Products

Reinforced Bars on top of:				
Steel Plates	Wire Reinforcing Coils	Steel Coils	Steel Pipes	Structural Steel Products

Reinforced Bars over Steel Plates

Ideally, rebar and steel plates should be stowed as separate adjacent stows. Where this is not feasible, the stow of rebar over 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 stow of steel plates depending on the amount of rebar to be loaded.



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



X Rebar and steel plates are both heavy cargoes. It is strongly recommended that they are stowed horizontally apart

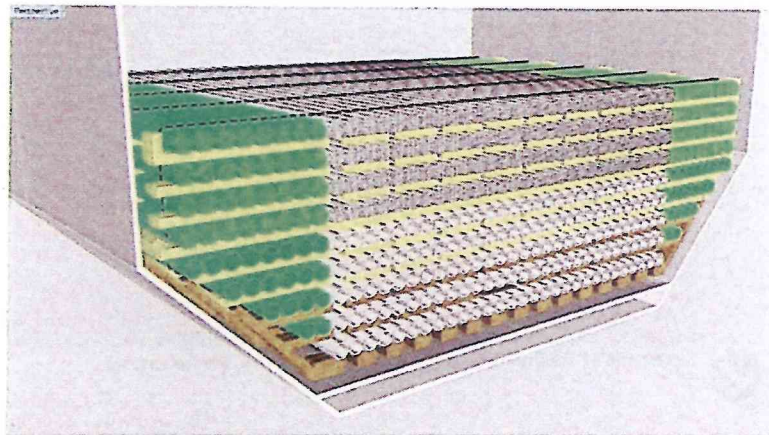
Combined Stowage of Different Steel Products

Reinforced Bars over Steel Pipes

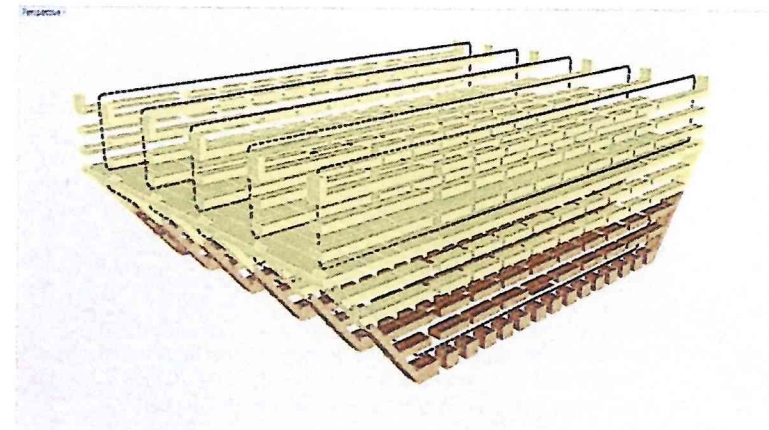
Rebar may be considered for loading over pipes if the pipes are not coated and in packaged form. The length of the rebar should not exceed the length of the pipes. The rebar and pipes must be loaded in a fore-and-aft direction.

The schematics below are indicative and for demonstration purposes only for a combined stowage of rebar over steel pipes. The sizes of the rebar bundles are identical to the pipe bundles. When different sizes of pipes are loaded under a stow of rebar, the dunnage and lashing for the stow of pipes should be

reconfigured to provide a levelled and stable stow of pipes. Wooden wedges should be considered for use with large diameter pipes. The dunnage between the two stows should be at least 100 mm x 100 mm of soft wood, provided that the stow of rebar is not significant in weight.



✓ Schematic showing stowage of rebar over pipes. Hardwood dunnage for the first tiers of pipes and soft wood dunnage for the subsequent tiers of pipes and rebar



✓ Schematic of the stowage of rebar over pipes. Hardwood dunnage for the first tiers of pipes and soft wood dunnage for the subsequent tiers of pipes and rebar. The two stows should be lashed separately

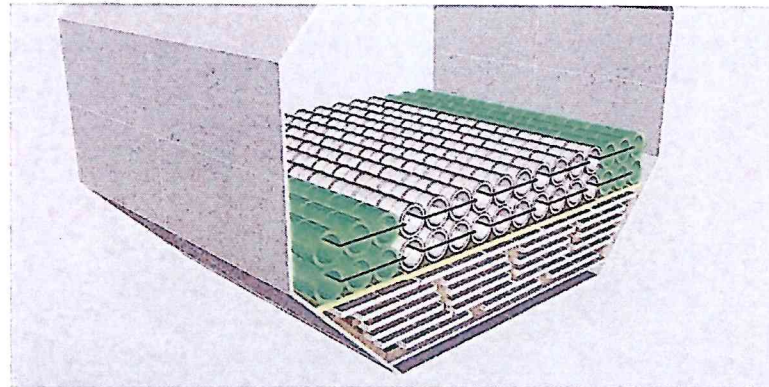
	Under-coaming stow
	Open hatch stow
	Soft wood dunnage
	Hardwood dunnage

Combined Stowage of Different Steel Products

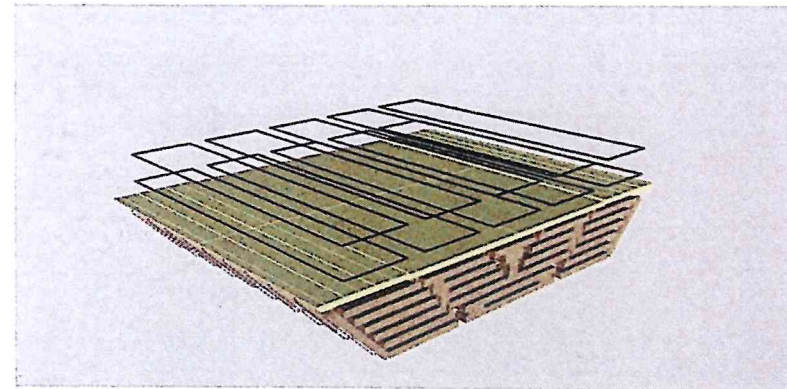
Wire Rod in Coils (WRIC) on top of:				
Steel Plates	Reinforced Bars	Steel Coils	Steel Pipes	Structural Steel Products

Wire Rod in Coils (WRIC) over Steel Plates



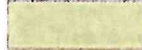

The schematics below are indicative and for demonstration purposes only for a combined stowage of WRIC over steel plates. The dunnage between the two stows should be of plywood sheets to protect the plates and their coating, in the event of bundled and packaged plates being stowed underneath the WRIC.



✓ WRIC loaded over steel plates. Plywood dunnage should be placed on top of the stow of steel plates. The plates should be lashed if not discharged at the same port as the WRIC. The stow of WRIC should be lashed separately



✓ Schematic of the dunnage and lashing approach for the two stows

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

Combined Stowage of Different Steel Products

Wire Rod in Coils (WRIC) over Rebar

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

Lashings

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

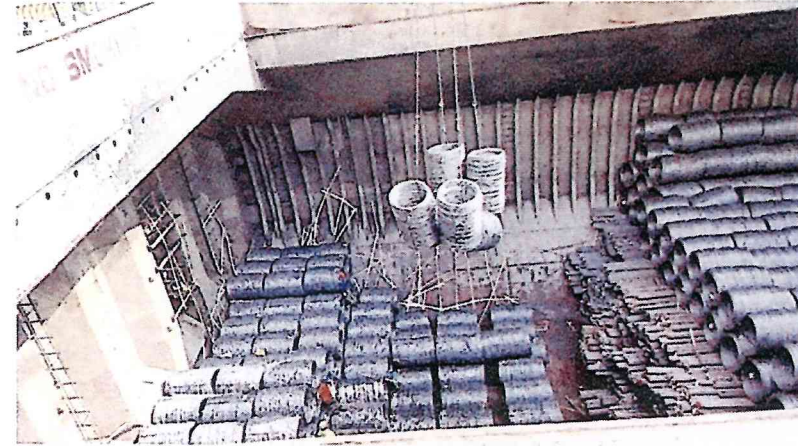
Under-Coaming Stowage

Where a forklift truck is to be used for the discharging of WRIC, working steel plate platforms should be placed on top of the WRIC and/or rebar tiers to protect these cargoes and to provide manoeuvrability for the truck.

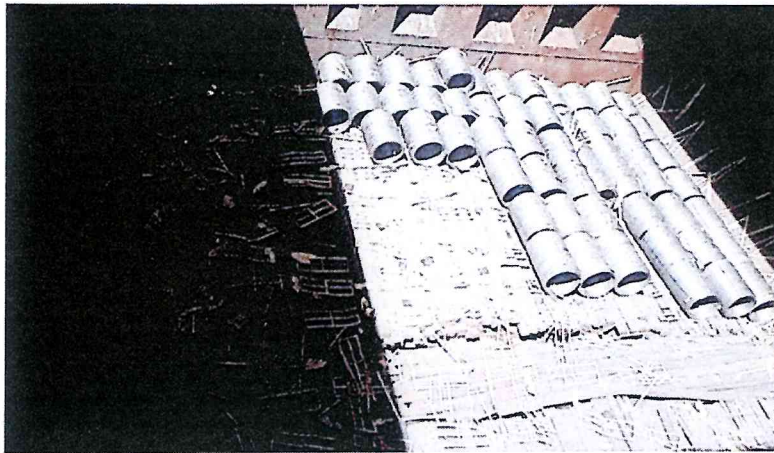
Combined Stowage of Different Steel Products



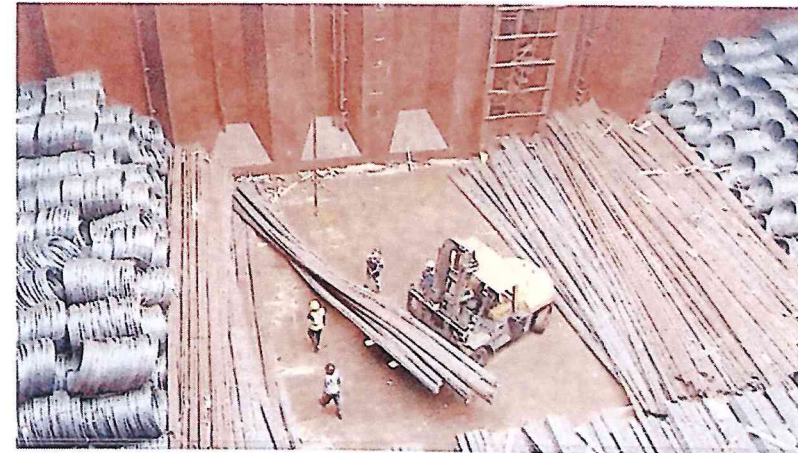
✓ Plastic sheets used to segregate the rebar from the WRIC



✓ It is important to level the rebar stow prior to loading WRIC on top



✗ Discharging of WRIC. The dunnage used to segregate the two stows has been crushed. It is recommended to lash the first rows of WRIC together prior to loading of the subsequent tiers



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

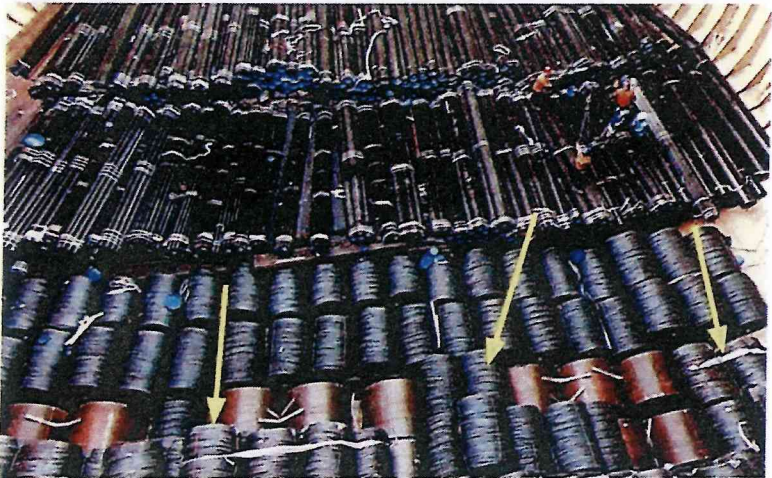
Combined Stowage of Different Steel Products

Wire Rod in Coils (WRIC) over Steel Coils

Stowage

Warning: WRIC must not be stowed over CRC because of the risk of damage to the packaging and the cargo. WRIC may be stowed on top of HRC only.

The lower stow of HRC must be loaded in accordance with the relevant guidance and over the full width of the cargo compartment. Generally, HRC have a low stowage factor and may contain heavy units of up to 30 tonnes.



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

Ideally, HRC should be in one tier with one or two locking coils. WRIC may be loaded as second, third and more tiers, provided that the structural integrity of the tank-top is not exceeded.

Lashings

The first tier of WRIC may be lashed to the HRC units using steel band straps.



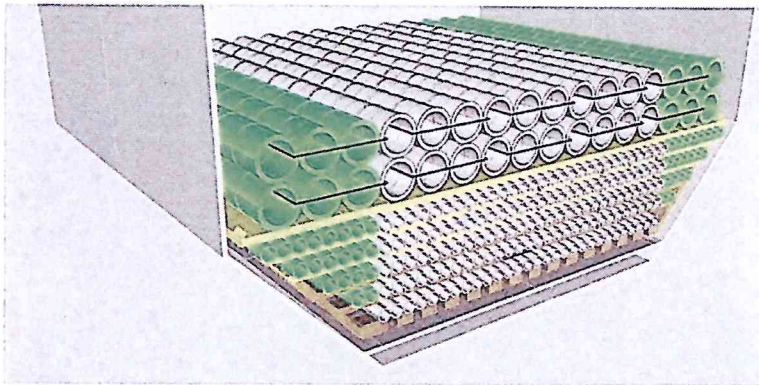
✘ The under-coaming stow of WRIC will be impossible to access with a vertical plumb of the crane. A forklift truck to provide access to the WRIC cannot be utilised

Combined Stowage of Different Steel Products

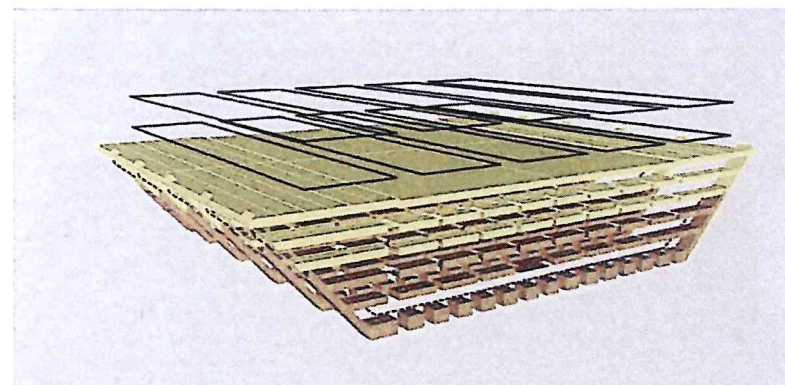
Wire Rod in Coils (WRIC) over Steel Pipes

The schematics below are indicative and for demonstration purposes only for a combined stowing of WRIC over steel pipes. When different sizes of pipes are loaded under a stow of WRIC, the dunnage and lashing for the stow of pipes should be reconfigured to provide a levelled and stable stow of pipes. Wooden

wedges should be considered for use with large diameter pipes. The dunnage between the two stows should be of plywood sheets to protect the pipes and their coating.



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



✓ Schematic of the dunnage and lashing approach for the two stows

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

Combined Stowage of Different Steel Products

Wire Rod in Coils (WRIC) over Structural Steel Products



X Insufficient dunnaging and lashing of the WRIC stow over the structural steel stow



X Insufficient dunnaging and lashing of the WRIC stow over the structural steel stow

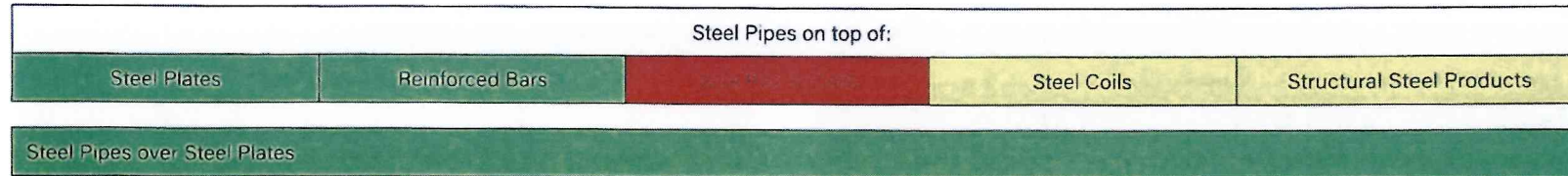


X WRIC over structural steel products over steel plates. The WRIC must be properly stowed, dunnaged and lashed when loaded in the under-coaming area



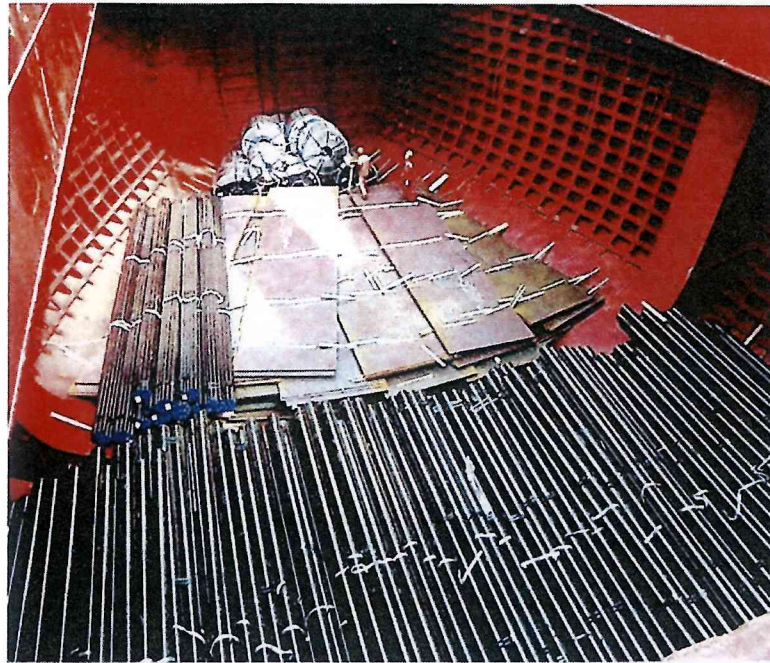
✓ Discharging of WRIC, stowed over structural steel products

Combined Stowage of Different Steel Products



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.



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

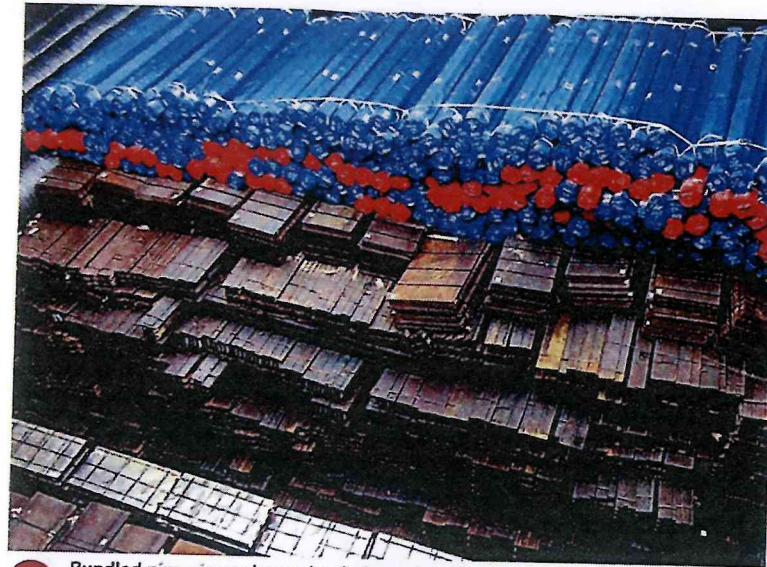


X The pipes should be pre-slung for ease of discharging. Proper stool dunnage between the pipes and the side bulkheads must be used

Combined Stowage of Different Steel Products



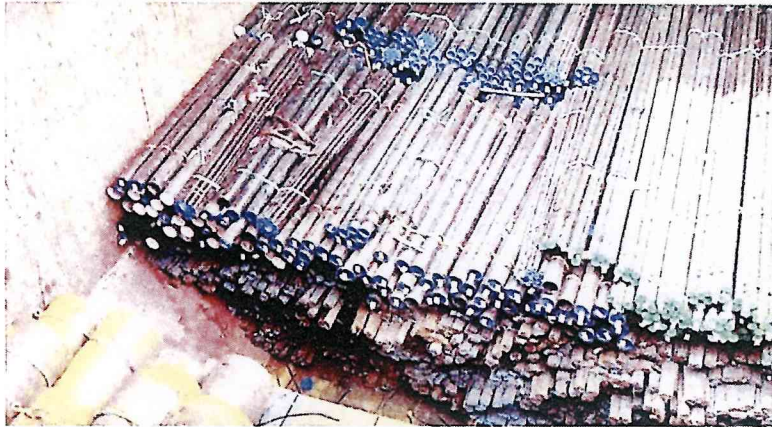
Pre-slung and bundled pipes loaded on top of steel plates



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. A similar dunnage arrangement should 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 level



✘ 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 CRC must not be considered. Stowage of pipe over HRC can be considered, provided the tank-top is not overloaded. The lower stow of HRC must be loaded in a fore-and-aft direction and over the full width of the cargo compartment.

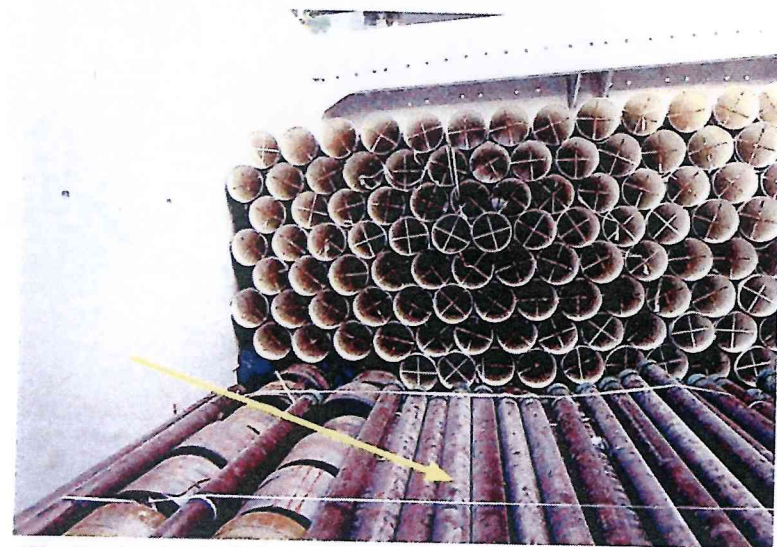
Because of the size and shape of the coils, the stow cannot be levelled in preparation for an over stow of pipes. Usually, large diameter pipes will

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 pipes. Pipe bundles should be either pre-slung, without dunnage, or with dunnage between the tiers if not pre-slung.

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



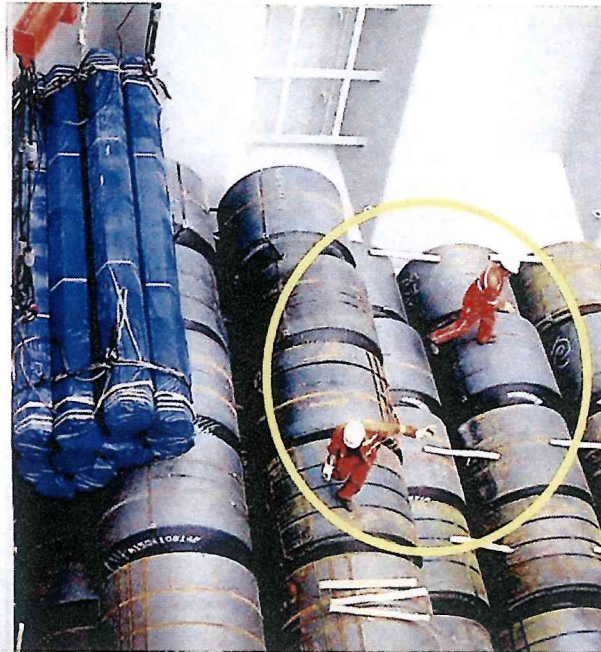
✓ Lightweight pipes loaded over HRC in a lower stow. The ship does not have side under-coaming areas



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

Combined Stowage of Different Steel Products

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



X Pipes loaded over HRC. This creates a high risk of overloading the tank-top and injury to personnel. No dunnage is used



X Pipes loaded over HRC. 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.

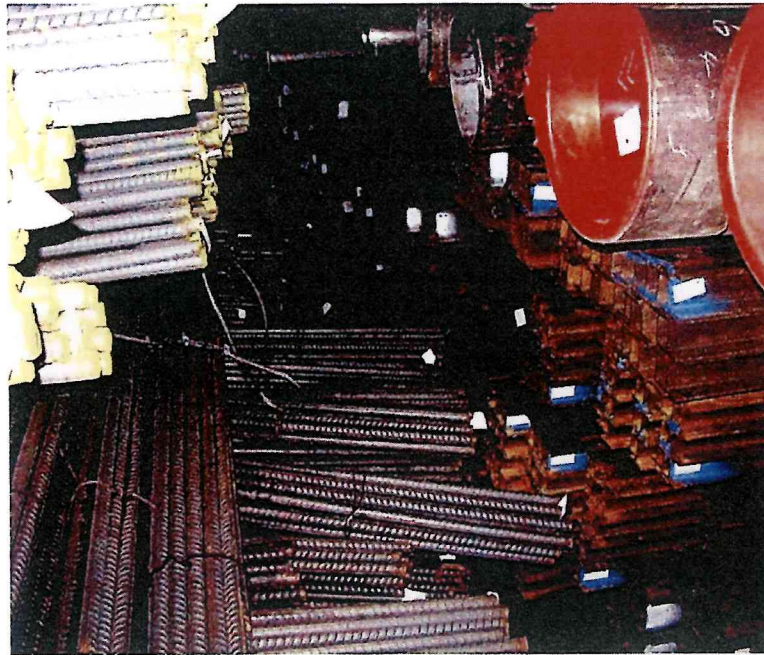


✓ Pipes may be loaded over some structural steel, such as H-beams and I-beams. In this photograph, the H-beams are also loaded on top of steel plates



✓ Pipes loaded over structural steel cargo in a box-shaped cargo hold

Combined Stowage of Different Steel Products

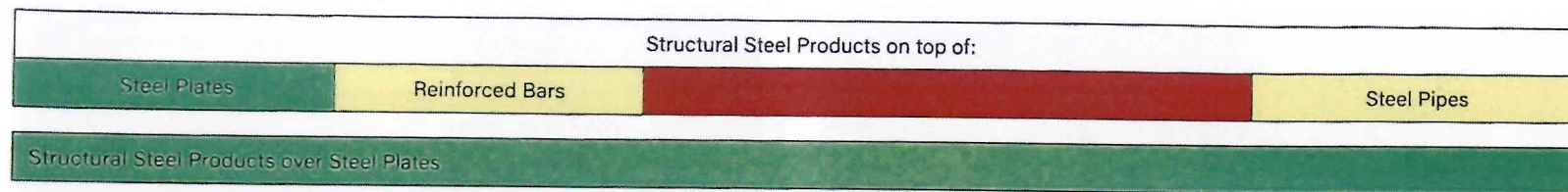


✘ Pipes loaded over structural steel products. Some of the pipes are too close to the adjacent stow of rebar and there is a risk of damage in the event of shifting and when discharging



✔ Bundled pipes loaded over structural steel

Combined Stowage of Different Steel Products

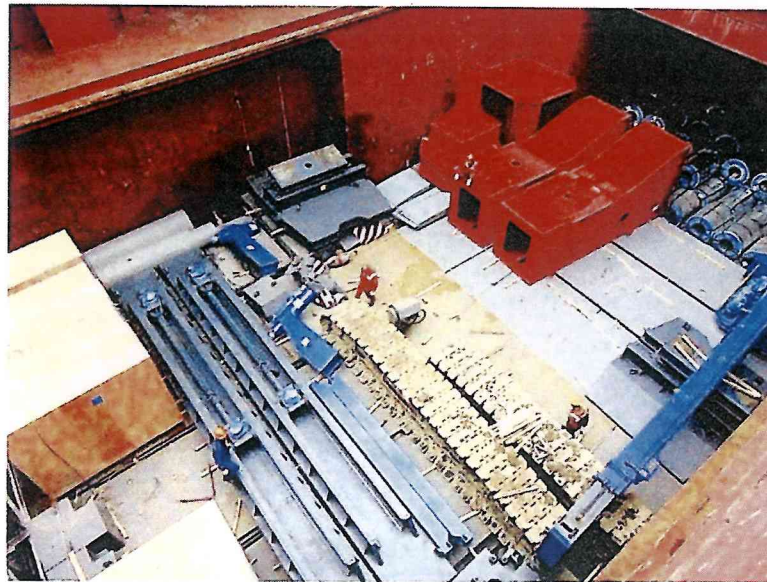


✓ Loading of palletised structural steel over steel plates. The stow of plates is properly levelled

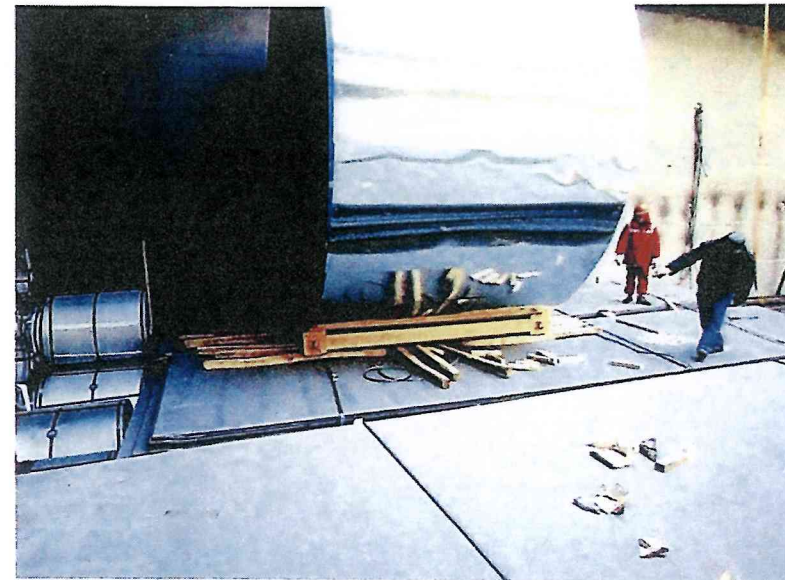


✓ Dunnage and lashing properly prepared for the stow of structural steel products

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 should 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



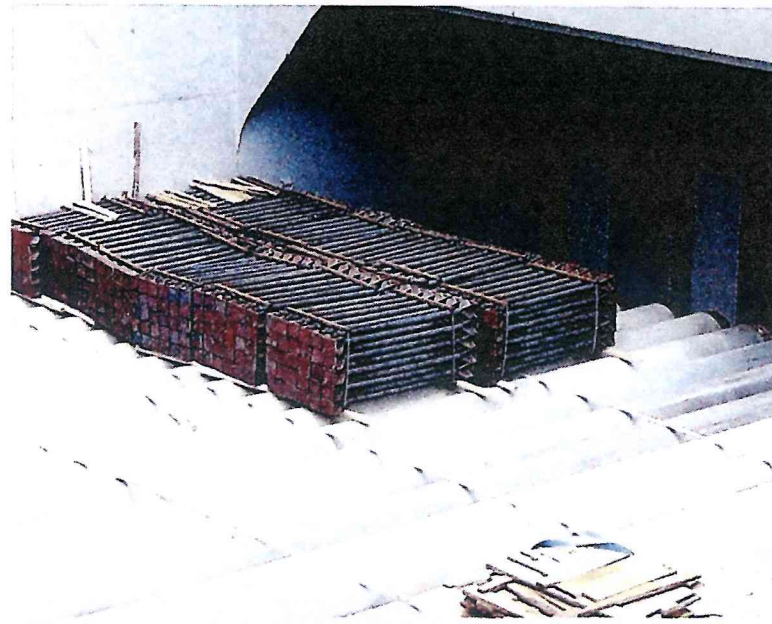
✔ Containers loaded over a well-levelled stow of rebar. The containers must be lashed in a uniform block of stow

Combined Stowage of Different Steel Products

Structural Steel Products over Steel Pipes

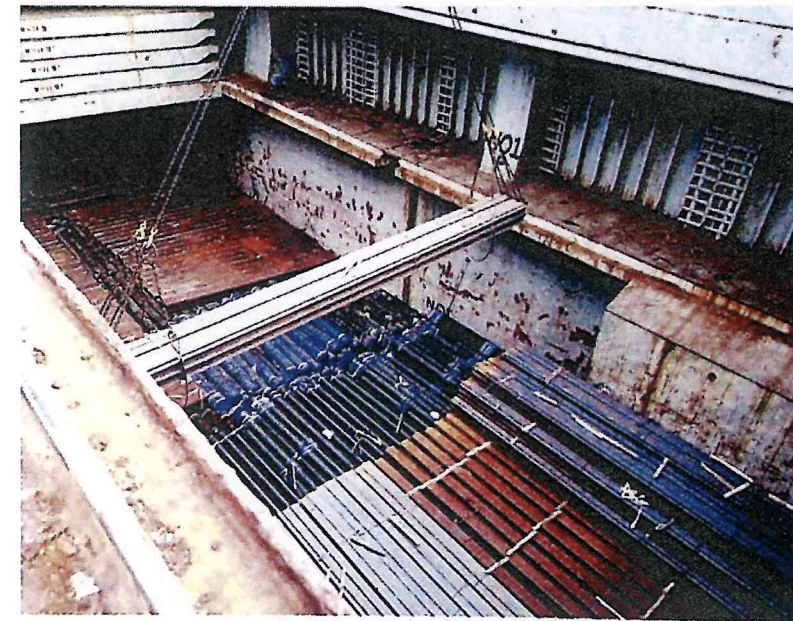
Dunnage

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 1,500 mm should be considered to ensure there is no direct contact with the pipes.



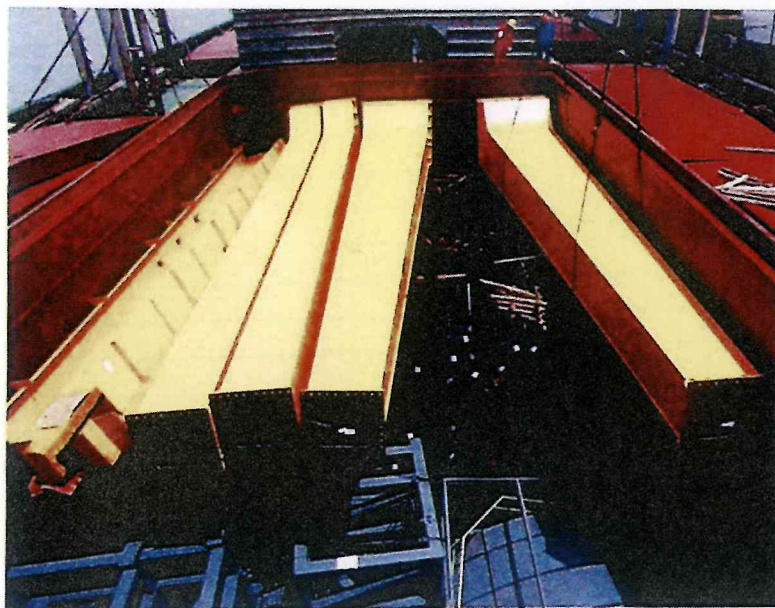
X Bundled palletised steel cargo loaded over pipes. Proper use of dunnage. No lashing preparation for the stow above the pipes

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

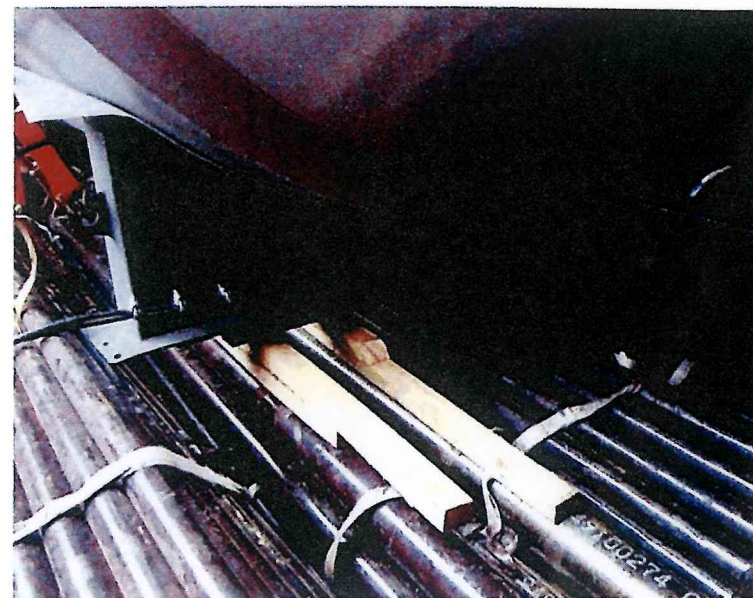


✓ Loading of general cargo units over pipes. The cargo unit must be lashed. Proper use of dunnage

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. In heavy weather, pipes have a tendency to move so this type of stowage should be avoided where possible