UK P&I CLUB

Allianz

Project cargo matters

Guidance on how to safely load, stow, secure and discharge heavy-lifts and project cargoes

UK P&I CLUB
IS MANAGED
BY **THOMAS MILLER**

Introduction

This publication is the result of joint industry collaboration between the risk management/marine risk control departments of the UK P&I Club and marine cargo insurers Allianz AGCS with expert independent input from Cwaves, a London-based marine surveying and consultancy company.

This collaboration came about due to increasing concerns about the lack of expertise, skills and resources being deployed in this complex area of shipping activities and a repeated number of significant damage losses to ships and cargoes combined with a series of near miss incidents in recent years.

The information contained in this publication is intended to provide guidance only and is not intended to replace, nor should it be used for, specific expert advice on the transportation of project/heavy lift cargoes.

Index

What is project cargo?

"Cargo or equipment that may be large, heavy or out-of-gauge, requires specialised stowage, lifting, handling, may consist of high value or critical items and typically consists of a quantity of goods connected to the same project, which may be loaded from different ports."

A wide range of cargoes fall within the definition of project cargo, from traditional break-bulk type cargoes (that meet the above quoted criteria) to large single items such as cranes or oil & gas modules.

The cargo insurers will stipulate certain conditions (a warranty) for the purpose of the insurance. If the cargo to be carried meets certain criteria (often referred to as 'critical items'), then certain procedures will have to be followed under the warranty. Critical items may fall under one (or both) of two broad headings:

1 Those that are critical because of the cost and difficulty of replacement and;

2 Those that may require unusual provisions for safe loading, stowage, lashing and discharge – whether all of those aspects or only one.

These criteria may include the replacement lead time, the value of the cargo (individually and / or in total), the size or footprint, weight, the centre of gravity and whether specialised transport, lifting and / or securing is required.

Cargo types that may fall within the definition of a critical item may include:

- Oil & gas equipment for onshore and offshore infrastructure
- Refinery and petrochemical plant equipment
- Renewables equipment for onshore and offshore infrastructure
- Modules and pre-assembled units
- Port handling equipment
- Port construction
- Floating cargo
- Rolling stock
- Heavy machinery
- Power plants and power generation equipment.

Critical items require special attention during their transportation, careful assessment and detailed planning of the operations is required for the transport to the load-port, loading, stowage, securing and discharge of the cargo.

Why is special attention required?

The answer is simple: The costs involved in project cargo damages or loss can be very large, often running into tens, possibly hundreds of millions of dollars. The risks involved can be largely mitigated with careful planning and attention, before the cargo is received for shipment.

In more difficult financial times, the pressure to reduce costs is very high and since the cost of shipment is essentially an overhead, there is a natural desire to reduce the shipping costs as far as possible. The use of unsuitable vessels for the cargo, poor quality or inadequate securing and dunnage, poorly trained crew and a lack of detailed planning can all lead to damage to or loss of the cargo.

The consequence of this will involve a claim against the cargo and / or liability insurance and potentially for the delays to the project (e.g. delay in start up). With many other parties involved and the consequential costs high, these claims are often complicated and may result in lengthy and costly litigation.

Damage to project cargo during transportation can cost many millions of dollars, cause extensive delays and potentially lengthy and expensive litigation!

Relevant regulations, codes and guidelines

It is the Master's responsibility to ensure that all cargo, whatever it is, is safely stowed, properly secured and handled (loaded/discharged) with care and in accordance with the requirements of the charterparty.

The charterparty may dictate specific responsibilities of the vessel owner, charterer and shipper such as the specific responsibility for stowage, lashing and securing of the cargo. For example there may be a requirement from either charterer's and/or cargo insurers for the appointment of an independent marine warranty surveyor (MWS) to review, approve and monitor all loading and sea-fastening operations. These responsibilities should be carefully assessed as they can greatly affect the liabilities if the cargo is damaged or lost during the loading, voyage or discharge. It is important that all relevant persons are aware of these requirements and their responsibilities.

The following *Regulations* are applicable and should be adhered to:

- *Flag state and Classification Society rules*:
  Always mandatory and includes the mandatory application of SOLAS for any applicable vessel. In particular SOLAS Chapter VI: Carriage of Cargoes is relevant and must be complied with. Regulations for lifting gear and operations will be found within the flag state or classification society rules.

The rules of the vessel's classification society will also set out the requirements for maintenance of the vessel, including equipment required for the loading, stowage and securing of project cargoes. If these requirements are not followed, the vessel's owners may be liable in the event of an incident.

- *Cargo securing manual:*
  The vessel's cargo securing manual (CSM) is a key document in the shipment of project cargoes. The CSM is a required document under SOLAS Chapter VI and shall document the types of cargo for which the vessel is properly suited to carry, how it shall be loaded, stowed and secured. It will also document the vessel's cargo securing equipment (an inventory) and their maintenance and inspection.
- *The CSS Code (IMO Code of Practice for Cargo Stowage and Securing, 2003; Resolution A.714(17))*:
  Sets out the general principles for the safe stowage and securing of a range of cargoes, including project cargoes and non-standard, heavy units that may require special attention. Annex 13 of the CSS Code sets out the method of calculation of the required lashing forces for abnormal loads. The CSM is based on the principles set out in the CSS Code.

  Note:

  One key aspect is that specialist knowledge and experience in the shipment of such cargoes is required to fully plan and engineer a safe project cargo shipment. The IMO CSS Code sets this out in Section 1.8, Special Cargo Transport Units:

> *"The shipowner and the ship operator should, where necessary, make use of relevant expertise when considering the shipment of a cargo with unusual characteristics which may require special attention to be given to its location on board vis-a-vis the structural strength of the ship, its stowage and securing, and the weather conditions which may be expected during the intended voyage."*

The IMO CSS Code is the main standard to be applied for the stowage and securing of project cargoes.

- *Intact stability regulations (The International Code on Intact Stability, Resolution A.749(18)):*
  A mandatory requirement that sets out the minimum stability standards for all applicable vessels. Damaged stability standards also needs to be considered (SOLAS Chapter II-1).

- *CTU packing guidelines (IMO/ILO/UNECE Code of Practice for Packing Cargo Transport Units (CTU Code), 2014):*
  Provides guidance and measures for ensuring the safe packing of cargo in containers and other cargo transport units (CTUs). Refer to the following link:

  http://www.unece.org/fileadmin/DAM/trans/doc/2014/itc/id_07_CTU_Code_January_2014.pdf

The following *Guidelines* are relevant and provide guidance on the best practice for the loading, stowage, securing and discharge of project cargoes:

- *DNV Rules for the Planning and Execution of Marine Operations*:
  The DNV 'Rules' provide some mandatory requirements for certain operations and some guidelines. Whilst mainly applicable to offshore operations, there are relevant sections on heavy-lifts, lifting appliances, loading and discharge operations that are relevant to project cargo shipments.

  https://exchange.dnv.com/servicedocuments/dnv/

- *DNV-GL Noble Denton Guidelines*: The DNV-GL Noble Denton Guidelines provide the technical basis for marine operations including the transportation of specialised cargoes. The guidelines include Marine Transportation Guidelines (Document reference: 0030 rev 5 or later), Marine Lifting Guidelines (0027 rev 10 or later), Mooring Guidelines (0032 rev 1 or later) and Load-out Operations (0013 rev 7 or later).

  http://www.dnv.com/industry oil_gasrules_ standards/noble_denton_rules_guidelines.asp

These guidelines are specialist technical documents and appropriate expert advice on their requirements and implications should be sought before they are used.

Vessel types and suitability

Various vessel types are commonly employed to carry project cargoes. These include:

- **Tween-decker:** The old-style general or 'break-bulk' cargo ship with multiple hatches, fixed tween decks and cargo handling via derricks or cranes has now largely disappeared.
- **General cargo ships:** That carry a wide variety of cargoes, including industrial items, bagged cargoes, project cargoes, steel products, forest products, palletised cargoes, smaller break-bulk cargoes and containers. They are un-cellular and have holds with moveable/stackable tween deck pontoons.
- **Multi-purpose and heavy-lift vessels:** Heavy-lift and multi-purpose vessels usually have wall-sided (rectangular) holds and moveable tween-decks, providing efficient stowage of a range of cargoes, using their own securing fittings. They are ideally suited to the carriage of project cargoes. Heavy-lift vessels are commonly defined as having cranes capable of a 100 tonne single lift. The cranes are usually sited to enable tandem working.
- **Bulk carriers:** Vessels with a number of holds designed to carry cargoes such as coal, grain, iron ore etc. This type of vessel may vary in size from only a few hundred tonnes to around 200,000 tonnes. The smaller sizes, up to around 50,000 tonnes may be fitted with cranes for self-discharge.

These bulk carrier vessels are sometimes chartered for project cargo transport, but are not well suited to this, as they do not have wall-sided holds, making safe and proper stowage difficult. The crews are often not familiar with the requirements for the stowage and securing of project cargoes.

Bulk carrier holds are not designed for the carriage of project cargoes. The shape of the holds makes proper stowage and securing difficult and will require stacking and over-stows. This can and often does result in cargo damage and potentially damage to the vessel.

- **Module carriers and semi-submersible heavy-lift vessels:** Vessels with all accommodation forward and a broad, flat deck, designed for the carriage of large modules. Loading and discharging is via self-propelled trailers, skidding or if semi-submersible, by float-on/off methods. Such vessels are usually fitted with sophisticated and highly responsive ballast systems (sometimes with stability pontoons) to allow fine adjustment of draught, list and trim as heavy modules are loaded.

***A purpose built heavy-lift ship designed for project* cargoes.**

The tween-deck of a purpose built multi-purpose vessel.

- **Barges:** A wide variety of barge types can be used for the transport of project cargoes, ranging from inland river barges, to large ocean going barges, sometimes self-propelled, ballastable 'dumb' barges requiring the use of pusher or tow tugs are available in some regions. Some are equipped with holds and hatchcovers. For larger project cargoes undergoing an ocean tow with tug, a large 'classed' pontoon (with a flat watertight upper deck) type barge would be utilised (spoon bow and raked stern with two box skegs). Careful consideration is required for the type of barge, tugs, towage arrangement, likely voyage conditions, the characteristics of the cargo to be shipped and the proposed method of loading/unloading taking into account local conditions e.g. tidal range, currents, mooring arrangements and other aspects. The condition of the barge should be carefully assessed, in particular the condition of the structure and essential systems (ballast system and manhole covers).

Voyage instructions

Summary of Master and crew responsibilities

The shipper's instructions may provide specific precautions which should be adhered to for the safe carriage of the cargo. These may be as simple as standard handling symbols indicating orientation or centre-of-gravity stencilled onto a packing case or a volume of information covering every aspect of carriage from factory packing to on-site unpacking and the conditions which must be met during transportation to ensure that a manufacturer's guarantee is honoured. Another aspect is 'basis of design' and design accelerations for heavy/project cargo (e.g. transformer, module)

The cargo insurers may require the attendance and approval of a warranty surveyor during transportation and any recommendations made by the surveyor with respect to the transport, must be adhered to. These do not remove or override the Master's ultimate responsibility for the safety of crew, vessel and cargo.

A clear understanding of each party's responsibilities and good teamwork is key to the success of project cargo transportations.

Shippers instructions

The shippers may provide instructions for the safe and proper stowage and securing of the cargo. These instructions may refer to matters such as whether the cargo unit can be over-stowed (i.e. can other items be stacked on top of it), the lashing and securing of the cargo (including the suitable lashing points on the cargo), the preferred stowage location (such as whether it can or cannot be stowed on deck), the required packing to ensure the protection of any internal components and protection from the elements.

For more complicated shipments, particularly those for large, heavy items, a detailed *transport manual* or *method statement* should be provided. Owners should ensure that this is provided in a timely manner. This is normally provided by the shippers to all relevant parties and should document all required procedures for the safe and proper shipment of the cargo including:

- Management of the project, responsibilities and key contacts

- Details of the cargo
- Details of the vessel
- Vessel strength and stability
- Port details
- Loading procedures, including any heavy lifts and if necessary, any transportation to the loading berth
- Stowage requirements
- Lashing and securing requirements, including details of all lashing, securing and lifting gear
- Voyage plan, including contingency procedures and ports of refuge
- Discharge procedures.

The transport manual, or method statement, should be complied with as this defines the procedures for the entire shipment. It will have been reviewed by people with the specialist knowledge required for critical shipments, such as a marine warranty surveyor (MWS) or cargo superintendent (supercargo).

The role of third parties

Third parties may be involved in the transport of critical items in order to protect the interests of certain parties. The common ones are the marine warranty surveyor and cargo superintendent, also referred to as the client's representative.

The marine warranty surveyor (MWS)

The MWS is appointed on behalf of the cargo insurance underwriters who insure the shipment of the cargo.

The MWS ensures that the terms of the warranty clause in the insurance policy are complied with and that the operations are carried out in accordance with the approved procedures as defined in the transport manual or method statement.

Involvement of an MWS is typically where shipment of the cargo forms a component of a larger project, including cargo comprising of relatively small cases or cargo transport units (CTUs) through to complete modules for new infrastructure projects. In the latter case the shipping procedure; transport to point of shipment, lift plans and rigging calculations, sea-fastening and routing of the ship or tow will be the subject of a series of procedures. These will have been subject to professional scrutiny, possibly by a number of disciplines, to ensure that calculations are proved and methods for the execution of the various aspects are approvable in line with industry guidelines.

Subject to the approval of procedures and calculations it is then normal for the warranty surveyor to attend and observe loading, securing and possibly discharging operations to ensure that approved procedures are adhered to and to be on hand to evaluate and approve any changes to procedures necessitated by on-site conditions.

In the case where smaller quantities of cargo are being shipped on break-bulk or container 'liner' vessels the warranty surveyor would typically consult with the chief officer and/or supercargo with respect to stowage position and method(s) of securing.

In cases where a warranty surveyor attends to approve loading and securing of cargo it will be usual for a *certificate of approval* (COA) or *letter of approval* (LOA) to be issued, on completion of operations, to confirm that the previously approved procedures have been adhered to or that he is satisfied with on-board securing arrangements agreed with the vessel's staff or supercargo. The COA/LOA may have additional recommendations attached; for example specifying checks to be made on lashings, records to be noted in the vessel's log etc.

The supercargo / client's representative

The supercargo, in many respects, plays a similar role to the MWS, but usually is appointed as the representative of one of the parties directly involved in the shipment such as the shipper, charterer or receivers.

The cargo

Types of project cargoes and their main characteristics

Project cargoes may come in many different shapes and sizes. The following summarises the main types of project cargoes and their key characteristics. Also listed are some of the other common used terms in connection with project cargoes.

Heavy-lift: There is no standard definition of a heavy-lift in weight terms, although the cargo insurance policy may set a weight figure as part of the critical item criteria (typically 50 tonnes, but may vary).

A 500T lift on a specialised vessel, loaded / discharged at safe berths may present less risk than a 50T lift at the limits of a vessel's safe handling capacity or loaded/discharged at berths not suited to handling such items.

Break-bulk cargo: Break-bulk cargo is a much broader group of cargo types that refers to cargoes that are loaded and stowed individually and not in containers or palletised. Certain project cargoes can fit within this category where they may be small enough to fit inside a vessel's holds, but require individual loading, stowage and securing.

Out-of-gauge: The term out-of-gauge refers to any cargo that has dimensions that exceed the normal dimensions of a standard shipping container.

Aspects to consider for project cargoes

What is the 'footprint' of the cargo? Where and how it will be stowed on the chosen vessel must be considered to minimise the risk of damage and / or loss. The three-dimensional space and position must be considered in relation to the vessel structure and other cargo units – the stowage of project cargoes (especially those in a break-bulk format) can often resemble a 3-D jigsaw and must be planned as such.

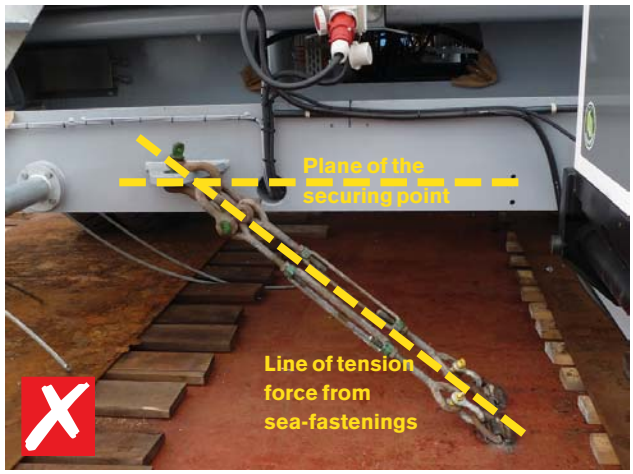
Cargo group	Examples	Comments
Oil & gas equipment	Process modules, accommodation units, sub-sea equipment, topsides, decks, complete platforms / jack-ups	Can be very large units weighing thousands of tonnes
Refinery and petrochemical plant equipment	Cooling towers, flash towers, storage tanks, pipe-racks, reactors, towers and similar	May have large dimensions, often deck space intensive
Renewable energy equipment	Wind turbine blades (carried in racks), nacelles foundations, mono-piles. Tidal turbines. Power cables (on non-specialist vessels)	Wind turbine blades (usually carried in racks) can be affected by longitudinal bending of the vessel due to their length. Hence, careful stowage and securing is required to avoid this
Modules and pre-assembled units	Often for oil & gas installations or refinery/petrochemical plants, such cargoes may include living quarters, pre-assembled machinery, generator sets, large pipe racks	Often pre-assembled into large structural framework for which careful lashing, securing and bracing is required to avoid distortion
Port handling equipment	Typically cranes and material handling equipment such as large container gantry cranes, ship-loaders, mobile harbour cranes, rubber tyre gantry (RTG) cranes, reach stackers	May consist of a framework, requiring careful lashing, securing and bracing to avoid distortion. Some units may have low lift stability
Port construction	May include pre-assembled items such as link-spans, jetty platforms, cat-walks, dolphins, single buoy moorings	
Floating cargo	A wide variety of vessels and craft, such as tugs, small ferries, yachts and super-yachts, small naval craft	Careful lifting sling positioning and restraint required
Rolling stock and heavy machinery	Locomotive engines and carriages, wheeled and tracked vehicles such as material handling lorries, excavators, trucked equipment such as mobile cranes, drilling rigs etc. Mining equipment, factory equipment	Often included as break-bulk project cargo. Proper stowage and securing required
Power plants and power generation equipment	Large generators, conductors, transformers and similar	

Project cargoes require clear positioning and stowage. Care is required to ensure that all units in the stow can be properly secured.

The stowage plan should consider the following:

- Is shoring required to hold the unit in position?
- Can enough lashings with sufficient scope be run to resist the forces that will be experienced?
- Its orientation with regard to any principal axes of strength in the cargo to the largest forces that will be applied to it?
- Can the cargo have other cargo stowed on top of it (over-stow); what is the weight limit for over-stow?
- Does the cargo need to be carried on deck? Does the charterparty or fixture specify whose responsibility and risk this is, as often owners will not wish to carry the risk for deck-cargoes?
- If carried on deck, is there a risk of greens seas affecting the cargo – is forward on the deck the right position for the unit, does it overhang the vessel's sides (significantly increases the risk of cargo damage)?

Lifting and securing points: The cargo must be supplied with appropriate lifting and securing points, particularly for large and heavy items. If the cargo unit is not supplied with adequate lifting / securing points, then attempts can be made to lift and secure the cargo in the best manner possible. However, if this is felt to present any risk of damage to the cargo (itself or surrounding), a note of protest should be issued at the time of loading. If the risk is felt to be significant (to the cargo unit, cargo as a whole or the vessel), then the cargo should be rejected.



Lifting and securing lugs (pad-eye) should not be subjected to forces out of plane of the eye as this will damage the eye and may lead to failure of the lashing.

The cargo lifting / securing points should be assessed to confirm that they are strong points and not merely attached to a protective cover, that they are structurally sound (are they intrinsically part of the unit), are they in plane to the principal forces to which the cargo is going to be subjected to (taking due account of the units position and orientation in the stow).

Cargo condition: The cargo unit, no matter its size, must be adequately packed and covered for its voyage to protect it from damage. If contained within an outer casing or protective packaging (e.g. wooden box), the casing must be secure, well fixed to the cargo unit so it does not come loose and cover all required parts of the unit. The unit should be well secured and packed within the casing.

If shipped without an outer protective casing, careful packaging and covering of any vulnerable parts or components is necessary to prevent damage from impacts and corrosion. Certain cargoes (such as coils, transformers, turbine components and similar) may be particularly liable to internal damage as they are sensitive to accelerations. These units must be properly packed, secured (including all internal components) and if necessary monitored during the voyage. Advice from the manufacturer and / or relevant specialists should be sought.

Any project cargoes shipped inside containers or other cargo transport units (CTUs) should be adequately

Cargoes should be well packed and properly secured inside CTUs. Failure to do so, can lead to extensive damage to the CTU, surrounding cargo and even the ship itself.

packed (stuffed), with appropriate shoring and internal securing, as with normal containerised transport.

The cargo should be inspected at loading and any damage recorded and noted.

Damage to the cargo observed on loading, even if only to packaging, should be noted and recorded.

Cargo information: Each cargo unit should be supplied with the appropriate documentation that provides the necessary information to ensure safe transportation. The general standard for project cargo information should always be 'comprehensive and accurate'. Almost by virtue of their definition, heavy-lift and project cargoes are more than averagely valuable and the consequence of their damage or loss proportionately more serious.

The weight and centre of gravity should be marked on each side of the cargo unit such that it is immediately visible.

> The documentation must include the accurate weight of the cargo unit, the accurate location of its centre of gravity (particularly important for heavy-lifts and possible off-centre units), its dimensions and details of the safe slinging, lifting and securing points. Of course, it is also vital to know what the cargo is.

The vessel

The cargo securing manual

All ships carrying cargoes other than solid or liquid bulk cargoes are required to carry and maintain a 'ship specific' cargo securing manual (CSM). It is a mandatory requirement of SOLAS and the CSS Code and will be approved by the vessel's flag state.

The purpose of the CSM is to set out the procedures and standards for the securing of cargo, taking into account the type of cargo, the characteristics of the vessel and conditions that may be encountered. It is intended to be a 'manual' and contain the relevant information and guidance to assist the crew in properly securing the cargo.

Guidelines for the production of the CSM have been published by IMO and various classification societies. In general, the CSM should provide documentation on:

- The securing devices carried on board (number, strength, inspection regime and maintenance) and arrangements
- The stowage and securing of non-standardised cargo, including evaluation of the forces and the appropriate calculation methods for determining the required cargo securing capacity
- The stowage and securing of standardised cargo units (e.g. containers), including securing devices, stowage requirements and evaluation of the forces acting upon the cargo units.

Vessel stability

The vessel must comply with the IMO Code on intact stability at all times. For large, heavy cargoes, it will also

be required that the Intact Stability Code is complied with during all stages of the loading and discharge operations. Therefore, the vessels stability should be checked for all key stages of the proposed loading / discharge sequences. This will include any lifting operations (cargo unit at furthest extension and highest crane boom position) and 'drive-on' (using self-propelled modular trailers for example) or floating operations (with semi-submersible vessels).

Where relevant, the effect of a stability pontoon should be included in the calculations.

For high value / long replacement time cargoes and / or if the voyage route is deemed to be high risk, additional stability checks will be required for a damaged state (e.g. a 1 compartment flooded condition). Also, even though a vessel may meet the IMO intact stability criteria, it may be considered that the vessel has too little (tender) or too much (stiff) stability.

Vessels with heavy deck cargoes may have a high centre of gravity (CG) and hence a small metacentric height (GM). This will result in a slow roll period, (tender) and she will linger at the maximum angle. The extended roll period increases the forces on the cargo and hence the securing devices.

Vessels with heavy cargo stowed low in the holds may have a low CG and hence a large GM. This results in a fast roll period (stiff) and she may roll violently. This violent motion increases the forces acting on the cargo and hence the securing devices due to the increased accelerations.

Consideration should be given to the weather conditions that the vessel may experience on voyage. For exposed, open ocean voyages, where bad weather is a possibility, the effect of the vessel's loading condition (GM and drafts) on her motions should be considered and any negative effects mitigated as much as possible. It is important to minimise the motions on the vessel (including possible wind heeling) as far as practically possible.

Rough weather combined with a high GM can result in violent motions, which if not properly planned can result with damage to or loss of the cargo!

Project cargoes for the oil industry, loaded on conventional vessels invariably include a quantity of drill and casing pipe. This, by its nature has to be bottom stowed in the holds, and the result is always a high GM, with its associated short roll period. In some cases this is as low as 7-8 seconds, which can result in violent rolling. High acceleration forces can and will be exerted on tween-deck and deck cargo lashings, and this should be taken into account during the planning and loading phase. Because the project cargoes can be relatively light but have a high volume, there is seldom sufficient deadweight in the whole consignment to bring the vessel down to a reasonable draft that will provide full propeller and rudder immersion. Hence, some bottom ballast will still be needed, which further increases the GM. Pumping out this bottom ballast will make little difference to the roll period, and will make the vessel difficult to handle in adverse weather, and steering or maintaining a certain heading will be more difficult. With a lighter vessel there is the added risk of main engine shutdown, as the governor will be working harder to avoid engine over-speed.

On conventional vessels an ideal roll period would be in the region of 15-20 seconds. A longer roll period, resulting from a too-low GM, will mean that the vessel will 'hang' at the maximum angle at the end of each roll, and any shift of cargo could result in loss of GM and the vessel reaching angle of loll, with no prospect of recovery without resorting to ballasting bottom tanks.

To summarise: the nature of the cargo will dictate the final GM, although consideration should be given during the planning phase to loading as many heavy units high up in the tween-decks, or on deck if permitted, to counteract the effect of the drill and casing pipe consignments in the lower holds. This will not be possible in the case of bulk carriers being employed to load project cargoes, as the heaviest units will have to be stowed directly over the pipe stows, or on the remaining tank-top areas in the holds, further increasing the GM. See also 'vessel suitability'.

Vessel strength considerations

The vessel will have defined weight limits for the tank-

When sea-fastenings fail under excessive vessel motions, the violent motion of large, heavy project cargoes can cause extensive damage to the vessel structure. Side-shell plating (in way of cargo holds), deck structures and hatchcovers are particularly vulnerable to damage. The repairs can cause extensive delays.

top, tween-deck and hatchcovers (tonnes per square metre). It is important that these limits are adhered to, particularly with heavy cargoes and this must be considered in the stowage planning.

For heavier cargo units, they should be placed over the frames of the vessel and additional load spreading may be required. Load spreading can range from dunnage or wooden mats, to steel grillages for heavier units which spread the load into the surrounding structure of the vessel. The grillage should be designed to take both the static weight of the cargo unit and the dynamic loads to which it is subjected on voyage. In many cases more sophisticated FEM software (ANSYS, Staadpro) is used to determine 'hot spots' in structural members of the vessels, whilst stowing heavy lift cargo. However this approach is exercised by naval architects or structural engineers, which are either employed 'in-house' or outsourced.

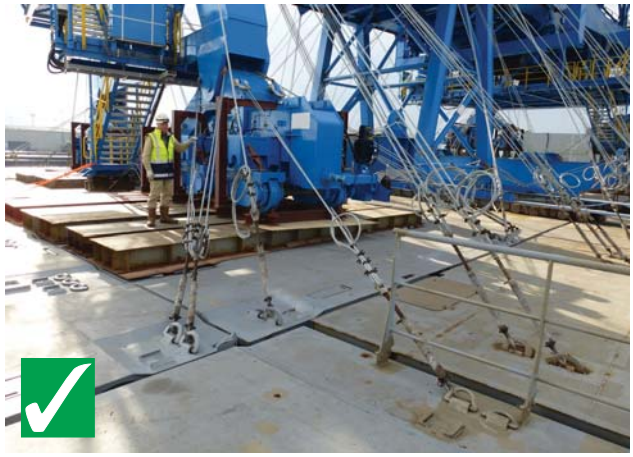
Where structural reinforcements, grillages or any other welded modifications are required, then the proximity to the vessel's bunker tanks or any other flammable source must be considered and the appropriate hot work procedures followed.

As per normal vessel operations, the longitudinal strength of the vessel (shear forces and bending moments) must be checked for all key stages of the loading and discharge operations and for the voyage condition. Project cargoes are typically volume limited (rather than weight) and hence the shear forces and bending moments, are usually within the vessel's permissible limits.

Securing points

The securing points fitted to the vessel and the surrounding structure to which they are fitted must be strong enough to withstand the loads (static and dynamic) imposed by the cargo during the voyage. This is particularly important in the case of 'hard' sea-fastenings such as welded stoppers.

Load spreading 'mats' to protect the structure of the vessel.



Lashing wires with sufficient scope and clear working space.

The securing points should also be located such that there is adequate room for the securing device to operate effectively. For wire lashings, the lashing should have a clear line between the cargo unit and the securing points on the vessel and must not run around corners of vessel structure or other cargo units.

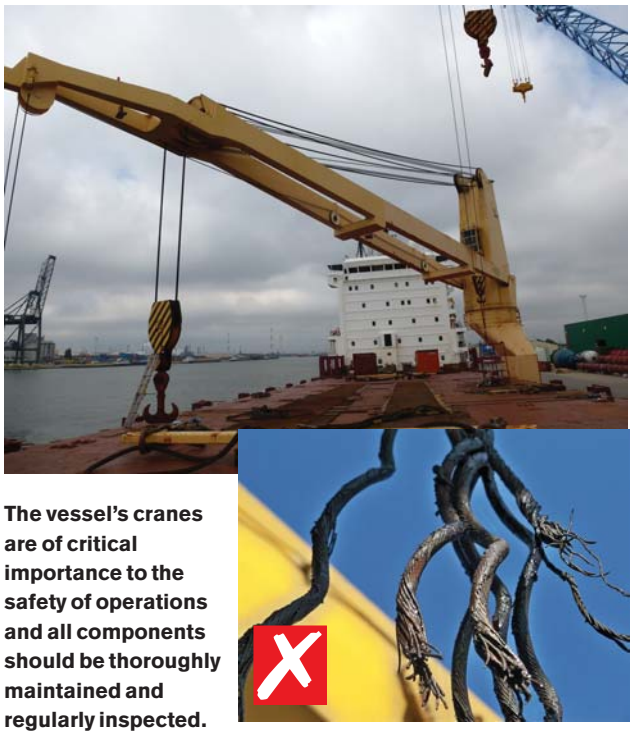
The positioning of sea-fastenings must be considered in relation to any adjacent cargo holds or bunker tanks and the requirements for additional securing points (e.g. D-rings) or hard stopper type sea-fastenings. Where welding is required for sea-fastenings and deck-fittings, 'hot work' procedures must be followed, particularly in respect of any welding in way of bunker tanks. Welding over or against fuel tanks is known to have caused many fires.

Examples of D-rings properly welded to deck (left) and poorly welded onto bulkhead (right).

Cranes and lifting devices

The vessel's cranes and lifting devices are of critical importance in the loading and discharge of project cargoes.

The maintenance of cranes and the operational procedures applied are critical to their safe operation. There are numerous examples of heavy-lifts being dropped due to failures of cranes and / or poor operational practices. The manufacturer's recommendations for maintenance should be followed and full records kept. The classification society inspection history and maintenance records (e.g. 'rocking' test results) are often requested for review.



The vessel's cranes are of critical importance to the safety of operations and all components should be thoroughly maintained and regularly inspected. A crane failure during a heavy lift will be catastrophic!

The manufacturer's recommended operating procedures should be followed and the cranes operating limits adhered to rigidly.

Careful maintenance of the cranes wires is also required, with regular inspections (full records should be kept) and defective wires replaced as necessary.

A very significant factor in incidents relating to cranes is the skill and experience of the operators. Heavy-lifts and in particular tandem lifts (using more than one crane at the same time to lift a unit) require experience and the appropriate training. It is recommended that suitable training be given to all potential crane operators.

Loading and discharge

The responsibilities of each party must be agreed and documented prior to commencement of operations and should set out the chain of responsibility, persons in charge and contact details for all relevant persons.

Instructions / information from shippers

The shipping note provides details of the contents of a cargo consignment to carriers, forwarders and receivers (see 'Voyage instructions' – 'Shippers instructions' page 6).

Industry guidelines and best practice

For any cargo movement, in particular for loading and discharge operations, a full and detailed plan must be produced and adhered to. The plan should take due account of the requirements and recommendations of industry best practice guidelines and rules (see section 'Relevant regulations, codes and guidelines' page 3).

Heavy-lift equipment and relevant requirements

Lifting gear may include wires, shackles, spreader beams, lifting blocks / hooks and should be documented onboard the vessel or with the crane (if shore-side). All lifting equipment should be certified and its safe working load (SWL) or

working load limit (WLL) and minimum breaking load (MBL) documented and made visible on the item itself.

Lifting lugs / eyes on the cargo unit should be located to provide a stable lift, accounting for any offset of the unit's centre of gravity. They must also be strong enough for the lift, including any dynamic lifting loads (see 'The cargo' – 'Aspects to consider for project cargoes' page 8). All lifting gear and lifting points on the cargo should be inspected before commencing the lift.

Lifting and rigging plans

For any heavy-lift, it is essential to properly develop and document a lifting plan that should define the procedures for the lift and provide accurate information on the centre of gravity of the unit, the proposed lifting spread to be employed and the calculation of the rigging stability (the lifting triangle). It should document the loads expected to be experienced and the safety factors used in selecting the lifting gear. It should also assess the need for centre of gravity corrections (e.g. use of water bags) and possible test lifts to ensure stability (insurance policy coverage should be checked in this case).

Case study: The lifting of units with a high centre of gravity (CG), can be challenging. In this case, the rigging arrangement was incorrect and allowed the crane to tip, which was initially caused by a strong wind gust. Because the stability of the lift was marginal, once the crane had started to tip, there was no means to restore it to upright in the rigging plan and it fell onto the deck of the vessel and quayside, causing significant damage to both.

All crane lifts should be carefully assessed to ensure adequate clearances with the cargo unit itself, vessel and port infrastructure. Tandem crane lifts must be planned in detail to ensure the correct synchronous movement of the cranes.

Limiting conditions and external influences

The lift should have limiting conditions imposed on it to ensure that the design loads for which it is rated are not exceeded. These will include limiting wind conditions, vessel motions (which may differ for in-harbour and offshore operations) and where positional accuracy is important, the lift may be limited to daytime hours only.

Significant crane slewing (rotation) and other horizontal motions should be assessed to ensure that the dynamic loads imposed are within the capacity of the lifting system. Similarly, lifting in to and out of water imposes additional loads on the lift and must be assessed.

Reference should be made to the relevant industry guidelines for the determination of these loads (see 'Relevant regulations, codes and guidelines' page 3).

Loading sequence and trim, ballasting

During loading and discharge operations, it may be necessary to carefully manage the vessel's drafts and trim. This is particularly important for 'drive-on/off' and 'float-on/off' operations. Careful ballasting is required to ensure that the required drafts and trim are maintained during the course of the operation and this should be properly calculated and documented. The ballast tank and pump capacity of the vessel should be checked to ensure that it is adequate, particularly for barge transports.

Other loading methods

- **Float on/off:** This method of loading and discharging is employed by semi-submersible heavy-lift vessels and submersible pontoon barges. Cargoes may include offshore platforms, jack-ups, other vessels (e.g. barges, tugs etc) and large project cargoes that are suitable for 'wet' loading / discharging. These vessels can be expensive to charter, but provide a safe and relatively fast option for transportation.
- **Skid-on/off:** Pontoon barges, module carriers and semi-submersible heavy-lift vessels are commonly loaded by cargo being skidded into position. Large oil & gas units (e.g. topside modules) are often loaded by this method. These are typically bespoke

Barge transports and loading / discharge by non-lifting methods requires specialist expertise and knowledge.

operations allocated to a specialised contractor.

- **Roll-on/off:** Wheeled cargoes can be driven onto and off the vessel. Many project cargoes are loaded / discharged using self-propelled modular transporters (SPMTs). SPMTs provide a flexible loading / discharge method and are capable of dealing with inclined and uneven routes.

Other matters

- **Ground-bearing pressure:** The ability of the load path (ashore) to withstand the weight passing over it without undue deformation, which might result in damage to the load path and/or a loss of stability of the load-transporting equipment. This can also be a factor with lifted loads, especially where a high capacity mobile crane is utilised. The loading capacity of port facilities should be determined and account taken of any damaged or degraded areas. Repair and/or consolidation may be required to provide a usable load-path over which a heavy unit can be skidded or driven, or a crane safely located. The transport of the unit to the load port and onwards from the discharge port must also be considered. A route survey may be required.
- **Transhipments:** Transhipment of cargo should, under ideal circumstances, be avoided as generally the cargo is at its most vulnerable when being handled. However there are circumstances when it cannot be avoided. Transhipment operations (especially vessel to vessel) require very detailed and careful planning.
- **Barge transport:** Whilst there are heavy-transport vessels capable of carrying modules of 2-3,000 tonnes quite often towed barge transport is the only reasonable solution to heavy lift transport, especially where large and heavy structures are concerned. These may include container cranes, large tanks or jackets and decks for offshore installation. Barge transport is inevitably slower than the use of an equivalent vessel. It will also require the fixture of a suitable towing vessel and may require more sophisticated voyage planning where a tow is lengthy or transits through known hazardous or adverse weather areas. Barge transports should be carefully planned as they are generally a higher risk method.

Management of operations

For any loading and discharge operation, the planning of the operation must include provision for hold points during the operation and ‘toolbox’ talks. These help to ensure the safe progression of the operation and that all persons involved understand the next steps, responsibilities and so forth.

Appropriate risk assessments including HAZID/ HAZOP meetings should be carried out, which should involve all relevant parties and be approved by all. This should also include ‘management of changes’ (any deviations from agreed procedures) to be documented and agreed by all parties.

Stowage requirements

As described on page 5, different vessels types are better suited to certain types of project cargoes.

They all have their specific advantages and

disadvantages, but in general the specialist heavy-lift vessels will be more expensive to charter, but are better suited to the cargo types typically shipped and therefore the overall shipment is safer. Cheaper vessels such as bulk carriers or general cargo vessels are often employed as they are seen as cheaper. However they are not designed to carry these types of cargoes and their use often leads to increased costs, either due to cargo damage claims or the extra design and work required to make the cargo shipment as safe as possible – this tends to nullify the perceived cost benefit.

Clearly, very large cargo units will require sufficiently large amounts of deck space and this often dictates the choice of vessel to those with the required deck space – usually specialist heavy-lift ships. This often means that the cargo is placed on deck and not in the holds. Suitable protection from the elements is then required. Deck cargoes will often be specified as being carried at shipper's risk and it is important to note this and take action accordingly.

Large cargo units will need to be carried on deck, requiring special planning of the stowage, required sea-fastenings (to allow for the higher CG) and protection from the elements. Stowage on forward hatchcovers is not advised unless absolutely necessary as vessel motions (in particular, pitch motions) are greater in this location and there is a higher risk of impact from seas shipped on deck.

Cargo securing

Cargo securing equipment

Cargo securing gear may include lashing wires, web lashings, chains, D-rings, turnbuckles, shackles. In project cargo terms these are often referred to as 'soft' lashings and as with the lifting gear, all of the equipment for cargo securing should be certified and printed with its SWL and MBL documented and visible. If carried by the vessel, the CSM should provide a full inventory of these items.

Also applicable are 'hard' sea-fastenings such as stoppers, braces etc, which are often constructed from steel plating and / or beam sections and welded to the vessel. These are typically used for larger, heavier cargo units and are usually used only once.

As with lifting gear, securing equipment should be well maintained and regularly inspected. Records of the inspections and maintenance should be retained. Prior to use, all securing gear should be inspected and if damaged, should not be used and should be replaced.

Types of securing

Wire lashings (direct or looped): Most common form of cargo securing, easy to stow (but must be wound / unwound properly), easily adaptable to shape

of cargo versus deck / hold lashing points, tension can be maintained on voyage (with turn-buckles or similar). Requires regular maintenance, can damage cargo so sheathing protection required, susceptible to damage, must be rigged properly to get full load capacity, needs re-tensioning during voyage (often difficult to determine what tension is), large number of wires required for larger, heavier items, can be difficult to handle, separate wires required for sliding and tipping resistance.

Web lashings: Better suited to smaller/ lighter cargo units and where cargo unit does not have dedicated lashing points, re-useable and easy to stow, soft material minimises damage to cargo, tensions with ratchet, easy to handle. Prone to chafing damage, limited strength so large number required, even for medium sized units,

As a general rule soft lashings will have their greatest effect if attached close to the plane of the centre of gravity of the item (subject to the structure of the item being able to withstand the motion forces expected) with angle of lashings as close as possible to 45° to the deck

Chains: Can provide higher strength capacity, less maintenance than wires, harder to handle and stow, difficult to keep taught, if loosens when using ratchet tensioners, chain will loosen in steps (by link) rather than gradually, potentially resulting in loss of tension, suited to stronger securing points, separate chains required for sliding and tipping resistance.

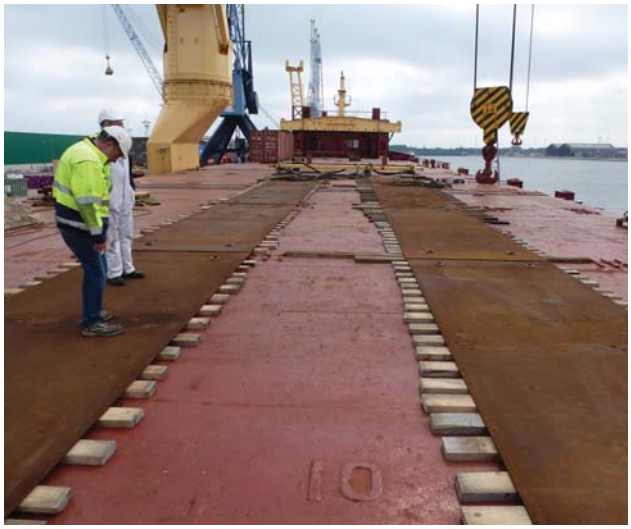
Lashing chains need to be properly tensioned and hence need to be secured to appropriate securing points to enable the tension to be created. The chains shown above provide good tipping restraint but minimal sliding restraint due to their high angle.

Web lashings may sometimes be used for smaller, lighter project cargoes, typically because they are cheaper than wires. However, they do not provide the strength that wire lashings do and are prone to chafing damage. Securing cargoes using web lashings like this (below right) will damage the webbing and reduce its effectiveness.

Sea-fastenings: Can include hard stoppers and braces, typically of steel construction and with welded connections to the vessel decks. Can provide combined resistance to sliding and tipping, can be designed to resist very large forces, well suited to large, heavy units of non-uniform shape. Requires proper design and engineering, higher cost and time to construct. Needs qualified welding contractors and non-destructive testing (NDT), care is required to ensure vessel's structure can take the imposed loads.

Dunnage, shoring: Wooden dunnage is required to be placed on the vessel's decks underneath the cargo. This is to provide greater friction between the cargo and steel deck and to assist load spreading. Dunnage is not used where the cargo unit is sat on a grillage or similar, which is designed to spread the load, but may be used as shoring or bracing to help position and maintain the cargo unit.

The dunnage used should be of good quality solid wood and not be of plywood type or similar construction. It should ideally be of horizontal grain (and not curved) to minimise the risk of splitting.



Securing methods

The options for the method of securing the cargo unit should be assessed and the most appropriate selected. This is typically undertaken by the charterers but is subject to the provisions of the charterparty. It is therefore important that each party understands their specific responsibilities. The vessel's Master should also ensure that he / she is satisfied with the cargo securing and should note any defect or concern about the proposed arrangements.

Certain cargo types, particularly large heavy items or units that cannot absorb any stresses, will dictate that certain types of sea-fastenings are required and whether 'hard' or 'soft' sea-fastenings must be used.

Hard sea-fastenings are those such as welded stoppers, braces and similar that are connected to the vessel's decks and will provide restraint of the cargo and spread loads into the surrounding structure of the vessel. Equally, if there is a direct connection (e.g. welded, pad-eye etc) to the cargo unit, they may impart stresses on the vessel to the cargo unit. In particular, this can occur with cargo units of sufficient length that longitudinal bending and deflections of the vessel are imparted into the cargo unit. Careful design of the sea-fastenings are required to ensure that this avoided, or if unavoidable, that the stresses imposed on the cargo are within the capacity of its own structure. Hard sea-fastenings will typically provide a greater restraining capacity and so are better suited to larger, heavier units.

Where cargo units may incur deflections due to the longitudinal bending of the vessel, the sea-fastenings must be carefully designed to minimise the loads imparted into the cargo unit. More complex sea-fastening designs are required based on specialist expertise. It is therefore important that sufficient time is allowed in the project for the proper design process to be carried out.

Soft sea-fastenings are those such as wires, straps etc which provide some restraint, but also have some 'give'. This 'give' is useful in avoiding the transfer of

vessels stresses into the cargo unit, but also means that the tightness of the securing needs regular checking to ensure that they do not come loose. Soft sea fastenings are generally cheaper and more convenient to use.

The design of the sea-fastenings must provide restraint against sliding and tipping in both transverse and longitudinal directions as well as against uplift. The design philosophy for the sea-fastenings should not mix hard and soft sea-fastenings in each mode of restraint, e.g. there should not be a mix for sliding or tipping restraint, however, each can employ different methods such as hard for sliding and soft for tipping.

For soft restraints, the optimum angle for sliding restraint is about 25 degrees to the deck, whilst for tipping restraint, the optimum angle is about 45-60 degrees. Hard sea-fastenings should be designed considering all relevant forces and stresses (and not just one mode of forces)

If necessary, bracing may need to be installed on the cargo unit to prevent distortion of the cargo unit under the loads experienced in a seaway. This is particular relevant for frameworks (e.g. modules for oil & gas installations) and large gantry cranes (e.g. container cranes, RTGs etc).

Where welding is required to construct the sea-fastenings, it must be ensured that this is not over or against any fuel tanks and that normal hot work procedures are followed. The welding must be of a high standard and it is normally required that specialist, fully qualified welders are employed to complete the welding of sea-fastenings. The welds must be tested to ensure that there are no defects and non-destructive testing (NDT) inspectors are used for this. The amount of NDT required varies, depending on the complexity and criticality of the project / cargo, but it is normally required that *a minimum of 20% of all welds is required* and in some cases, 100% of all welds may be required. In addition to any NDT testing there should always be a 100% visible inspection of all seafastening welds.

It is essential that the welders and NDT inspectors are properly trained and qualified.

The voyage

The voyage plan

The voyage plan should be critically assessed for the route, likely weather conditions (affecting cargo stowage and securing), proximity to areas of navigation danger, exposure to weather conditions (duration and how open the area is) and areas of known piracy activity. Different criteria will apply for open ocean voyages, compared to sheltered voyages of limited duration. Considerations should be given to the use of weather routing. Adequate fuel reserves should be maintained on board the vessel for the duration of the voyage. The usual recommended minimum reserve is 20% or 5 days fuel reserves

The current best management practice plan for avoiding piracy risks should be followed (BMP4).

The voyage route should include contingency plans in case of emergency events or forecasted weather exceeding the limits defined in the stowage and sea-

Examples of welds, showing very poor quality welding (top left), D-ring after NDT inspection which was passed (right) and sea-fastening weld to deck that failed the NDT inspection due to the presence of weld cracks (bottom left).

fastening calculations. Ports and areas of refuge should be identified and should ideally be reachable within a reasonable accurate weather forecast time (2-3 days sailing usually).

During the voyage, the stowage and securing of the cargo should be regularly checked (as far as safely possible) and any lashings tighten if they have loosened.

Where a marine warranty surveyor (MWS) is involved, the vessel will be required to provide daily reports of voyage progress and reporting on the condition of the cargo. This is usually a small addition to the normal reporting process for owners and charterers.

Voyage reporting

Reporting requirements and requirements of third party such as warranty surveyor / cargo interests (incl. checking of securing, reporting procedures etc).

A MWS may provide a certificate or letter of approval to confirm that the vessel can depart and that all procedures have been complied with. The certificate / letter may contain a number of recommendations which must also be complied with as a requirement of the warranty for the insurance policy. The recommendations will typically include limiting weather conditions for the voyage, the requirement to regularly check the sea-fastenings, and reporting requirements

A certificate or letter of approval may also be provided for critical operations such as heavy lifts or load-out / load-off.

Record keeping

As with any cargo handling, it is important to keep records of the operations, both for log entries and future reference. It is recommended that the crew make notes of the operations as they progress and whilst on voyage. Handwritten notes (or crew's notebooks) should be retained in the normal fashion. For more complicated cargoes, the notes should be extensive and represent a pro-active approach – just providing basic log entries is not informative.

With the proliferation of digital cameras and high quality cameras incorporated into mobile phones, duty officers should be encouraged/instructed to take as many photos as possible, especially during loading. Video clips of critical heavy lift operations can also be taken. Photos and video clips are particularly helpful to investigators and experts in case of cargo loss or collapse, and could help protect interests in case of litigation.

Recommendations

Allianz AGCS and the UK P&I Club would always recommend the procedures contained within this document are always followed and whenever doubts arise that the appropriate expertise is sought, consulted and appointed as necessary.

For further information and guidance please contact any of the undersigned:

Graham Bell
Master Mariner MNI MBACS
Global Project Cargo Specialist
Senior Risk Consultant Marine, ARC Marine
Allianz Global Corporate & Specialty
Direct: +44.1904.4897400
Email: graham.bell@allianz.com

Capt. Rahul Khanna
Global Head Marine Risk Consulting
ARC Marine
Allianz Global Corporate & Speciality
Direct: +44 (0) 20 3451 3154
Email: rahul.khanna@allianz.com

Karl Lumbers
Director – Loss Prevention
UK P&I Club
Direct: +44 20 7204 2307
Email: karl.lumbers@thomasmiller.com

Other relevant publications

Thomas' Stowage, Captain G.M. Pepper, publ. Brown & Son, 2012;

Cargo Work for Maritime Operations, D. J. House, publ. Elsevier 2005;

Lashing and Securing of Deck Cargoes, Captain JR Knott, publ. Nautical Institute, 2004;

Survey and Examination of Ships' Lifting Appliances, publ. UK P&I Club and Lloyd's Register

http://www.ukpandi.com/knowledge/article/survey-and-examination-of-ships-lifting-appliances-3645/

ACKNOWLEDGEMENTS:

Simon Burnay MEng (Hons) MRINA
Consultant Naval Architect
Tel: +44(0)207 083 7188
Email: s.burnay@cwaves.co.uk
Web: www.cwaves.co.uk

Annex:
Useful checklist for transportation of project cargo

Key points

Project cargoes require special attention during loading and transportation. Specialist knowledge and experience in the shipment of such cargoes is required to fully plan and engineer a safe project cargo shipment. All operations need to be carefully managed with agreed responsibilities, risk assessments and toolbox talks.

Vessel types and suitability

Project cargoes typically require specialised vessels with sufficient deck space, heavy-lift capability, 'tween-decks' and 'wall-sided' holds. Multi-purpose or heavy-lift vessels are best suited. Bulk carriers are not suited to this task and this has resulted in large cargo damage claims.

Responsibilities

- The successful transport of project cargoes requires good teamwork
- The responsibilities of each party should be defined and agreed (shipper / charterer / vessel owner / receiver / contractors)
- A proper transport manual or method statement should be prepared and agreed by all parties
- A marine warranty surveyor (MWS) may be involved, on behalf of cargo insurers.

Key rules and guidelines

Mandatory

- Charterparty requirements
- Flag state / Classification society rules
- Stability regulations: Intact and damaged
- IMO CSS Code / Vessel Cargo Securing Manual
- CTU packing guidelines.

Guidance

- DNV-GL Rules for Marine Operations
- DNV-GL Noble Denton Guidelines.

Cargo condition

- The cargo must be adequately packed and protected for its voyage to protect it from damage during sea transport
- Cargoes shipped inside containers should be properly packed (stuffed), with appropriate shoring and internal securing
- The cargo should be inspected at loading and any damage recorded and noted
- The cargo must have adequate number and strength lifting and securing points.

Cargo footprint and stowage location

- Project cargoes are often high volume, but relatively low deadweight
- The 'footprint' of the cargo is often large and does not allow 'over-stow';
- The positioning of the cargo and its sea-fastenings must be considered in relation to the strength of the deck, lashing locations and securing points, any adjacent cargo holds or bunker tanks and the requirements for protection from the sea / elements;

Cargo securing

- Sea-fastenings must provide restraint against sliding and tipping for transverse, longitudinal and uplift motions;
- The vessel must have adequate securing points (D-rings etc) to provide adequate securing for the cargo. Where securing points are being fitted, follow normal hot work procedures and consider the location with respect to fuel tanks etc;
- All securing gear must be rated for its SWL, MBL and have an inventory;
- 'Soft' sea-fastenings (e.g. wire lashings, chains etc) are adaptable, cost effective, reusable and easy to maintain. Proper rigging and re-tightening on voyage is required.

- ‘Hard’ sea-fastenings (stoppers etc) are effective for sliding restraint and larger items, but generally only useable once and may require specialist design and fabrication
- ‘Hard’ and ‘soft’ sea-fastenings should not be mixed in each mode of restraint, e.g. there should not be a mix for sliding or tipping restraint.

Heavy-lifts

- A detailed lifting plan is essential. It should address rigging arrangements, safe working loads (SWL), lifting points and the stability of the lift
- Cranes must be well maintained, following manufacturer’s recommendations. Operating limits should be adhered to
- Heavy-lifts and in particular tandem lifts (using more than one crane) require experience and appropriate training.

Vessel strength/load spreading

- Consideration must be given to the vessel’s load limits for hatchcovers, tween-decks, tank tops etc;
- Heavy cargo units should be placed over the frames of the vessel and additional load spreading may be required (grillages)
- Wooden dunnage (solid wood of good quality) should be used to provide friction and assist load spreading
- The global longitudinal strength of the vessel must be checked for all key stages of the loading and discharge operations and for the voyage condition
- For long cargoes, care is required to avoid transferring vessel longitudinal bending loads into the cargo. Specialist expertise may be required to design the sea-fastenings.

Vessel stability

- The vessel must comply with the IMO Code on intact stability at all times. Damaged stability scenarios should also be assessed for high value cargoes
- Even if the IMO intact stability criteria are met, a vessel with high GM will be ‘stiff’ and impart high forces to the cargo. The design of the seafastenings must consider this and efforts made to reduce GM
- The use of ‘slack’ ballast tanks to reduce GM is poor practice and can lead to structural damage.

Voyage planning and contingencies

- The voyage should be critically assessed for the route, likely weather conditions, areas of navigation danger, exposure to weather, as well as areas of known piracy activity
- The voyage route should include contingency plans in case of emergency events or forecasted weather exceeding the limits defined in the stowage and sea-fastening calculations
- During the voyage, the stowage and securing of the cargo should be regularly checked (as far as safely possible).

How to handle project cargoes

The annex above is also available in a handy, pocket-sized aide memoire – part of the ‘How to’ series. For copies, contact the Loss Prevention Department at Thomas Miller P&I Ltd.

UK P&I CLUB
IS MANAGED
BY **THOMAS**
MILLER

For further information please contact:
Loss Prevention Department, Thomas Miller P&I Ltd
Tel: +44 20 7204 2307. Fax +44 20 7283 6517
Email: karl.lumbers@thomasmiller.com