ΑΚΑΔΗΜΙΑ ΕΜΠΟΡΙΚΟΥ ΝΑΥΤΙΚΟΥ

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Τίτλος Πτυχιακής Εργασίας:

DIFFERENT WAYS OF DISCHARGE AND STOWAGE

ΕΠΙΒΛΕΠΟΥΣΑ ΚΑΘΗΓΗΤΡΙΑ:

ΠΑΝΑΓΟΠΟΥΛΟΥ ΜΑΡΙΑ

ΣΠΟΥΔΑΣΤΗΣ : ΓΕΩΡΓΙΟΣ ΚΟΣΜΑΔΑΣ

ΑΓΜ :3313

Ημερομηνία ανάληψης της εργασίας:

Ημερομηνία παράδοσης της εργασίας:

Α/Α	*Ονοματεπώνυμο*	*Ειδικότης*	*Αξιολόγηση*	*Υπογραφή*
1				
2				
3				
ΤΕΛΙΚΗ ΑΞΙΟΛΟΓΗΣΗ				

Ο ΔΙΕΥΘΥΝΤΗΣ ΣΧΟΛΗΣ : Τσούλης Νικόλαος

Introduction for both Stowage & Ways of Discharge

Stowing Procedures On Board

The stowing procedure on board describes the placement of cargo to a vessel or ship, that provides optimum safety for itself and the cargo, gives maximum space usage and allows easy access to cargo to a point of offloading. In shipping, the stowage factor indicates how many cubic meters of space one metric tone (or cubic feet of space one long ton) of a particular type of cargo occupies in a hold of a cargo ship. It is calculated as the ratio of the stowage space required under normal conditions, including the stowage losses caused by the means of transportation and packaging, to the weight of the cargo. The stowage factor can be used in ship design and as a reference to evaluate the efficiency of use of the cargo space on a ship. The aim of ship's officers and crewmembers on board should be to prevent damage or deterioration while the cargo is under their care and to deliver it, as far as possible, in as good condition and order as it was when received aboard. If unacquainted with a certain type of cargo you should ascertain as to its nature and any necessary precautions. Therefore, the Master and officers of all vessels require a good working knowledge of the various kinds of cargo they are likely to carry: their peculiar characteristics, liability to damage, decay, or deterioration, their measurement, and the usual methods of packing, loading and discharging, stowage, dunnaging, etc., as the Master is responsible for the safe loading of his vessel and the proper stowage of the cargo

The stowage factor differs from one type of commodity to another — for example iron ore has a stowage factor of 0.40 (m3/mt), meaning that the space needed by one tonne of ore is only one sixth of that required to stow one tonne of woodchips that have a stowage factor of 2.5. This means that if a ship designed to carry woodchips is loaded with iron ore, only a small part of the hold capacity can be utilized, and a bulk carrier designed to carry iron ore cannot be loaded to the maximum draft with woodchips, leaving much of its deadweight tonnage unutilized. Thus the stowage factor is taken into account in ship design when determining the size of cargo holds, and specialized ships such as ore carriers and car carriers are built for cargoes with a stowage factor that departs significantly from the average.

The stowage factor also depends on the type of packaging, being the lowest for unpackaged bulk cargo.

Type of cargo	Stowage factor	
	(cu ft/LT)	(m^3/MT)
Iron ore	14	0.40
Grain (heavy)	45	1.30
Coal	48	1.40
Woodchips	90	2.50
Containers (TEU)	56–105	1.6–3.0
Cars	150	4.2
Light crude oil	37.6	1.07
Heavy crude oil	33.7	0.95
Water	35.315	1

ΠΙΝΑΚΑΣ 1 VARIETY OF STOWAGE FACTORS

Discharging Procedures on Board

The discharging port is a place where a vessel (ship or aircraft) is off-loaded and the shipments are dispersed to their respective consignees. It may or may not be the port of destination. Also called port of unloading. Once after unloading the cargo at port of discharge the importer can complete customs procedures at port of discharge or he can arrange to move the cargo to nearest freight station of his choice where customs department functions. Your carrier may arrange to move the cargo accordingly to the said place by road or rail.

ΕΙΚΟΝΑ 1 VESSEL DISCHARGING WHILE DEBALLASTING

At first without deck or 'partially roofed' rowing boats and the larger later sailing ships loading and unloading was done exclusively with workers who loaded the cargo in his hands, which were usually in barrels. This packaging for wet, dry or semi loads (flour, paint dust, grease, etc.) were the most common for the era of wooden ships. Because the old wooden ships normally pulled water was the best packaging barrels which defended their content does not get wet.
* Of the casks in English tunne or tun came the word ton capacity which is a unit of vessel capacity that is not going to tone weight.

But for the same case in Greek we use the word saturation capacity of the Jewish Cor or round container is the single Hebrew-da main measuring liquids equivalent to 220 Lit.sti shipbuilding capacity unit. So the removal of tissue for merchant ships the loaders (Derricks) the principal means discharging. This is the period when steam or motorized cranes were first used as a means of cargo instead of derrick. The cranes were actually more manageable, but had weight volume and installation costs much larger than loaders nevertheless the cranes evolved and became lighter with greater

capacity and various shapes depending on the type of ship and cargo destined to discharge. Today there are various types of cranes. The need creating specific types of specialized ships to carry certain loads eg. heavy objects general cargo insured to reduce the cost of loading to reduce the time spent in port, to limit damage of goods and the need for stability of frozen cargo, bulk, vehicles, liquid cargoes, liquefied petroleum gases, was the reason to develop and to diversify the means of cargo. Despite the evolution of the average cargo ships the heavy burden of a stevedore operations for freight transport costs led to the mechanization of these operations in most ports.
With the mechanization of these operations work workers working
in these works became lighter the time of loading and unloading and also shortened the time and transport costs declined .Today less and less used means of ships especially in the bulk cargo ships and developed the means of loading and unloading ports.

In cargo ships can distinguish two cargo variants:

A) Direct handling from ship to train carriages or cars
or vice versa.
B) Indirect stevedoring where the load of the ship is placed in the warehouses of the port and after some time loaded from the warehouse in wagons or cars or otherwise .The direct handling is more efficient because it requires less time and costs until it reaches the load on the recipient.

The various instruments used for loading and unloading ships according to their function, we can separate them:
1) media handling
2) The auxiliary transport port
3) help tools

Part I Various Ways of Discharging Operations
Attributes of the Discharging Operation of Bulk carriers

1.1 Use of Derricks

Derricks were used on board for loading and unloading goods and heavy objects. Made of seamless steel tube and is thicker in the middle than at the edges.

ΕΙΚΟΝΑ 2 TAKEN FROM GOOGLE THIS IS A 1975 VESSEL WITH DERRICKS

The length of the Derricks depend on:

A) On the length of the opening of the hold in which the derrick is located. The larger opening has, the longer the Derrick.
B) On the width of the ship. The larger width has, the longer the Derrick. They have such a length that they protrude from 2 to 5 meters from the ship's side at the lower working angle.
C) From the position they are relative to the longitudinal plane of symmetry from aft to forward. The closer in this line are, the farther it is the derrick .Main characteristics of each derrick is how much load can be lifted safely, without the cause of an accident and rigging to suffer some damage. In addition to the normal wear period. The trunk of each derrick and near the base of the bond see some features SWL 15 ° meaning that the derrick has safe working level of 5 tons to a lower angle of 15 ° .The first SWL acronyms are the words safe working load.

1.1.2 Parts of Derricks

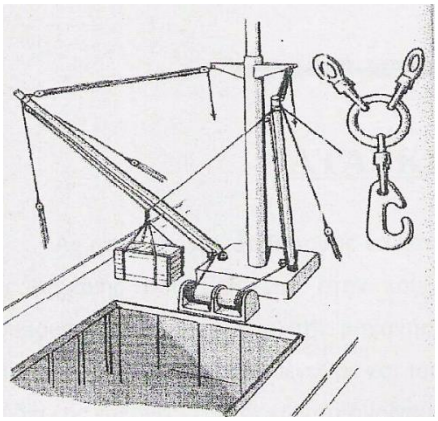
A) The BODY of the Derrick called boom as mentioned above, is a steel pipe, seamless, fatter in the middle to prevent bends and thinner at the edges. The bottom is joined to the needle and the screw. The upper part of the derrick has a topping lift and wires called ‘’guys’’.

B) Span or TOPPING LIFT is a single or double orthosis, depending on the construction of the derrick contains a stiff wire attached to the head which allows to lower upper or adjust to the desired angle for handling. The lowering or uppering procedure is performed by an auxiliary wire that goes into the headboard of the derrick or spinning wheel that has an independent motor.

C) CARGO RUNNER (Ronaris in Greek) is a bendable wire which at one end is a hook for lifting the load. The other end passes through the top load on the head of the derrick from the base and going to the drum of the winch. Lowering or going up the cargo we perform the same action on the cargo.

D) REIN FOR CEMENTS (Refortsa in Greek) are thick ropes, coming alongside the guys, to protect them in case of heavy and keep the derrick in place. Their top end is connected with a key to the eyebolt on the head of the derrick. The lower end has chain or other system, allowing variation of the length

1.2 Union purchase In order to perform Americana Discharging way



ΕΙΚΟΝΑ 3 APPLICATION OF THE AMERICANA DISCHARGING OPERATION

Usually all ships have in each hold two derricks and often in large cargo holds two derricks floating and two treble. For the loading and unloading procedures we use a combination of derricks called (union purchase) .The one placed at the proper height above the mouth of the hold and vertical load, in order to be loaded or unloaded. The other is positioned towards the outer part of the vessel allowing the loading and unloading waterfront. Both loaders are stable.To preserve more free space between the loaders the outer mortars are replaced the Americana's mortars which is used between the loaders to achieve rotation of the loaders adjusting their angle.

1.2.1 Describing the attributes of the Americana discharging operation

A) The two damned are mutually connected through swivels with a common hook.

B) The angle of the damned at their connection point never surpasses 120 degrees.

C) The weight that is lifted at any point must not surpass the 1/3 of the SWL.

D) Before the initiation of the Americana operation it must be checked and approved by an experienced officer.

E) The external slide have been strengthened by placing refortsa.

After the completion of the discharging operation we prepare the vessel for departure, by lowering the derricks in a horizontal way and we place their edges on special bases where they are locked & secured.

1.3 Discharging Operation with Cranes

In many futuristic and up to date vessels instead of derricks (chapter 1.1) special cranes have been installed. These cranes perform exactly the same job as the derricks only faster and more sufficiently avoiding the complicated functions derricks own. Cranes can lift way more weight than the derricks but their severe drawback is their cost of built and the maintenance they require. If we place two cranes together each one of them can discharge up to one cargo hold. But both can be used together in one combination.

ΕΙΚΟΝΑ 4 M/V BLUE CAT TAKEN FROM MARINE TRAFFIC IS A 2011 CRANE BULK CARRIER

1.3.1 Attributes of the Cranes

A) They require greater space than derricks do on the deck and they are operated by one person.

B) Once the cranes are lifted, they can be used as twins and their lifting skill may reach up to 160 tons of cargo.

C) Some parts of the crane are I) the tower ii) the bracelet iii) swivel pedestal.

D) Once we have cranes on board we have much more space on the deck because there aren't any winches or slides, and they are cause plausible for the users.

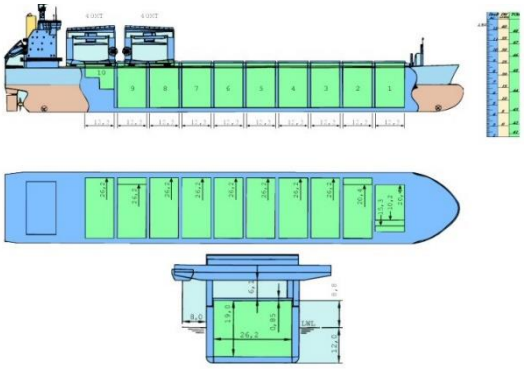
E) They are very low chances to have any accidents on board.

F) For their proper and correct use the crew has to provide big quantities of grease so any malfunction do not occur.

1.4 Travelling Cranes

In some new container vessels, general cargo and bulk carriers brand new travelling cranes are being installed placed forward and aft on hard rails which allows us to discharge and transfer cargo. Their deck and especially the part where the rails are installed have severe strengthening. Their handling is quite easy and can be performed by one crew member. Many time one travelling crane can suffice all the cargo holds, and they have a shape of a capital letter.

On most occasions the travelling crane can move above two side to side rails so that the crane can discharge one big rectangular area. On the other side on circular area can be serviced by the help of a rotary travelling crane that is place on the side of the vessel and on higher ground so it does not affect the use of the blank space. If the construction of elevated tracks is impractical, then the ends of the bridge can be fitted to vertical metal towers (pylons) that run on tracks above the deck. The cranes they are-known as scaffolding or cranes with Goliath cranes



EIKONA 5 DRAWING OF THE TRAVELLING CRANE

1.5 Combination of Cranederricks

Cranederricks as they are called are lonely derricks and are commonly used in bulk carrier vessels. They are of much more use than common derricks and they have greater cost, because of the extra winches that are used together. Their length surpasses the common ones and they are of much stronger construction. We put one in each cargo hold, and if the cargo hold is very big we put one forward and one on the aft above the center line of the vessel.

EIKONA 6 VESSEL HAVING A COMBINATION OF CRANEDERRICKS

1.5.1 The kinds of Cranederricks

There are two kind of Cranederricks that have different kind of characteristics.

A) The first kind has functions such as the common derrick. It contains a cargo runner (Chapter 1.2) which is connected to the winch. The legs go to an independent drum, to another winch. The ‘’guys’ are wire and wood blissfully replaced. The edges of the guy is wounded on two reels independent winches which are interconnected. In this case we need three winches to initiate the crane derricks. Those three winches are:

I) One for the cargo runner to upload and discharge the cargo

II) One for the leg to lower and upper the derrick

III) One for the special mechanism of the ‘’guys’’

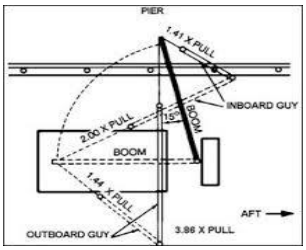
The handling motors of these three winches are concentrated in one place in order to be easy for one person to deal with all of them simultaneously.

B) The second kind which most commonly viewed it contains a crane derrick that doesn’t have a leg, but also the guys aren’t like their previous form. Guys are in such position that represent both the guys and their legs. The cargorunner has his own winch and so does the guy’’

ΕΙΚΟΝΑ 7 A CRANEDERRICK VESSEL BY MARINE TRAFFIC

1.6 Jumbo Derricks Boom

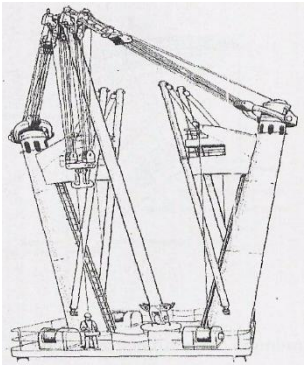
Common Bulk Carriers have derricks of strong construction that are called Jumbo Derrick Booms. Today those booms exist by companies by Stulcken, Velle & Hallen which can lift up from 25 to 600 (Guynless Omni range type).



ΕΙΚΟΝΑ 8
OPERATION OF A JUMBO DERRICK BOOM

1.7 Stulcken Type Derricks

Stulcken Type Derricks origins from Germany. There are two V-shaped webs between which and on the vessel longitudinal line position the derrick. It shall enter into operation quickly and easily stackable for travel almost vertical with full equipment. The most common loaders of this type are SWL275 tones. The initiation takes about eight hours. A man handles all four winches using two levers, one for each tissue. The torsion achieved by lifting one boom and loosening another. There are two types of these loaders:



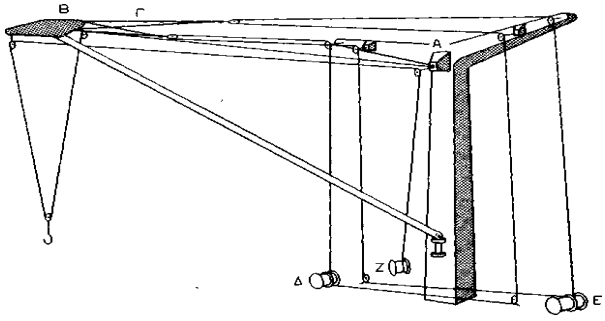
ΕΙΚΟΝΑ 9 - ΜΑΓΓΙΟΡΕΣ- IN GREEK TAKEN FROM WIKIPEDIA

A) **Double Pendulum** where twisting to the other side between the tissues. If we remove the rod connecting the two hoists at the bottom of it, the boom is then raised slowly to the vertical position. By the time you get to the other side using rope until the booms take the full weight of the system.

B) **Single Pendulum** which brings the hoist to hoist on one side of the loader and automatically passes from the forward to the aft position.

1.8 Derricks VELLE Type

The tissue of this type is T-shaped .The charger operates controls on a fixed basis or load control box bearing two lever positions and automatic return to neutral position when released (joystick) for controlling the hoisting winches and pivot derrick. Also bring automatic reset lever for controlling the winch hoisting load.



ΕΙΚΟΝΑ 10 DERRICK VELLE TYPE

Is it possible to be simultaneously three movements, depending on the weight of the load, we can achieve great speed loaded or unloaded as if on an experienced operator. The usual safe working load of these loaders are 10-50 tones.

1.9 Discharging Operation through Endless Belts

Their belt always travel in the same direction and consist of strips of various materials depending: on the needs of the load. It ribbon or transfer film. This system is applied successfully when the cargo is packaged in boxes or bags and in bulk then results in time savings. The conveyor belts are divided into mobile and stationary gravity acting on rollers. With endless belts loading and unloading is cm-1 directly from the ship to shore or vice versa. The speed of loading depends on the manipulation and skill of the workers and the stack.

Nominell arbetslast Nominal carrying capacity for each basic configuration	Färgkod Colour of sewn webbing component	WLL = Arbetslast / Working load limit K & A SYNODINOS SA								
		Rakt lyft Straight lift	Snarat lyft Choked lift	U-lyft Basket hitch	U-lyft Basket hitch		2-parts lyftlänga 2-leg sling		3 och 4-parts lyftlänga 3 and 4-leg sling	
SYNODINOS		100% WLL kg	80% WLL kg	200% WLL kg	140% WLL kg	100%	140% WLL kg	100%	150% WLL kg	210%
					45°	60°	45°	60°	45°	60°
1000	Lila/Violet	1000	800	2000	1400	1000	1400	1000	2100	1500
2000	Grön/Green	2000	1600	4000	2800	2000	2800	2000	4200	3000
3000	Gul/Yellow	3000	2400	6000	4200	3000	4200	3000	6300	4500
4000	Grå/Grey	4000	3200	8000	5600	4000	5600	4000	8400	6000
5000	Röd/Red	5000	4000	10000	7000	5000	7000	5000	10500	7500
6000	Brun/Brown	6000	4800	12000	8400	6000	8400	6000	12600	9000
8000	Blå/Blue	8000	6400	16000	11200	8000	11200	8000	16800	12000
10000	Orange	10000	8000	20000	14000	10000	14000	10000	21000	15000
över 10000	Orange									

ΠΙΝΑΚΑΣ 2 SWL & WEIGHT CAPACITY OF ENDLESS BELTS DISCHARGING OPERATION

1.9.1 Discharging Operation of endless belts (Mobile tape worm type)

This consists of steel cylinders by means which moves continuously consisting of strips of various types of material and accordingly the needs of the load. The strips are made of special implementation (specialized rubber) .The strip is placed in such a position that an edge is in the mouth of the hull and the other on the quay.

It is regulated address for transfer in different parts of the hull. The means continuous movement help fast loading also can be covered to avoid exposing the load to the elements. The system can be permanent or mobile installation.

ΕΙΚΟΝΑ 11 DISCHARGING OPERATION THROUGH ENDLESS BELTS

1.9.2 Vertical Endless Belt Lifting Discharger

This type of equipment is mainly used in refrigerated ships and for loading bananas. Various types are vertical conveyer belts or hoist devised to carry goods in the holds of ships. Goods to be discharged should be of equal size and equal weight to be successful work. Also, these transporters have been successfully used for unloading frozen ovine, goods in barrels etc. can be used both for loading and for unloading. Carriers are usually constructed in such a way so as to unload the load rises vertically from the hull and transferred horizontally to the pier. In other cases, portable conveyor belt vertical load transferred upward to the opening of the hull, so it is transferred to the side of the ship, and from there to the pier through a portable conveyor belt.

The vertical conveyor belt consists of a steel frame, bearing series revolves cylinders acting on two endless chains. The chains are attached with metal spacers every 3 feet. Such transporters are constructed in such a way that during unloading of the cargo from the hold when lifted directly transported to the dock.

1.10 Wooden sliding shuts

With the above successfully is loaded in the hold, the weight of sacks of flour straight from the factory. The speed of loading depends on the ability of workers in the hold, which quickly stow their descending bags.

ΕΙΚΟΝΑ 12 PORT WORKERS DISCHARGING FLOUR SACKS

1.11 Discharging Operation through Spiral conveyors

Spiral conveyors are located in different ships to load oil in boxes packed in pairs. Spiral conveyors are specially designed so as to be positioned inside the hull of the ship by crane. By moving rollers and gravity, the individual boxes are supplied with said carrier downwards helically transported in the hold. The carrier base is equipped with a ring of gravity rollers, the individual boxes after leaving the carrier are classified into the hold. In his book B. Stern 'cargo handling and working conditions Dockers states that a spiral

ΕΙΚΟΝΑ 13 SPIRAL CONVEYORS IN AUSTRALIA BUNBURY

conveyor on average 83.2 boxes loaded in man. The spiral conveyor is also used for loading and unloading of crude sugar.

1.12 Discharging through side lockers

Unloading through the side ports is mainly used for loading operation concerning timber. It also deals with packaged products (packaged freighters stowed on trucks) .There are also ocean-going ships, particularly passenger - freight ferries ferries which are equipped with side lockers. At various ports there is the problem where the height differs between the side window of the ship and the wharf due to variable tides and seagoing ships. This difference causes several problems in handling. In other ports there are enhancements built to avoid the above difficulties.

ΕΙΚΟΝΑ 14 VESSEL DISCHARGING TIMBER AT THE PORT OF DALIAN CHINA

Attributes of Discharging Operation on Vehicle Carriers - RoRo

1.13 Port facilities for discharging vehicle carriers

The main equipment for discharging the vehicles from the Ro-Ro's vessels type is through catapults. The catapult joins the hinges between the catapult and the forehead of the ship. For lifting and lowering the catapult, hydraulic cylinders or ropes are used, or we could meet a combination of the two above.

The catapult at its procedure of lowering and closure is utterly secured by padlocks which may be hydraulic, or pins that are placed by hand or by manual jacks. Also when the vehicle carrier has a second garage at a higher point for both loading and discharging operation bars are used which are lifted and lowered by combination of wires and hydraulic pumps, and their closure is secured by hydraulic pipes. At the most recent car

carrier vessels lofts are frequently used, on which cars are placed carefully. Those lofts are placed on the roof of the garage and are lowered with wire ropes and hydraulic bottles based on vertical columns, so if a storm occurs they do not tremble right or left.

EIKONA 15 THE INSIDE OF A RORO VESSEL

Attributes of the Discharging Operations on Tankers

1.14 The main Type of Pumps that are used nowadays on Tankers

The pumps used until 1950 was mainly reciprocating and rarely were able to provide cargo in quantities exceeding 500 t / h, since the war, and then developed the most efficient centrifugal pumps whose performance in U.L.C.C. reaches more than 8.000 t / h is estimated that the yield of the pump must be possible to place the entire quantity of the load to 12 hours. Ever since things have utterly changed adding several improvements to the discharging pumps of the Tankers, Chemicals, Oil Carriers. So now our main list of pumps consist of:

A) Reciprocating Pumps (Palindromic)

B) Centrifugal Pumps

C) Rotary Pumps

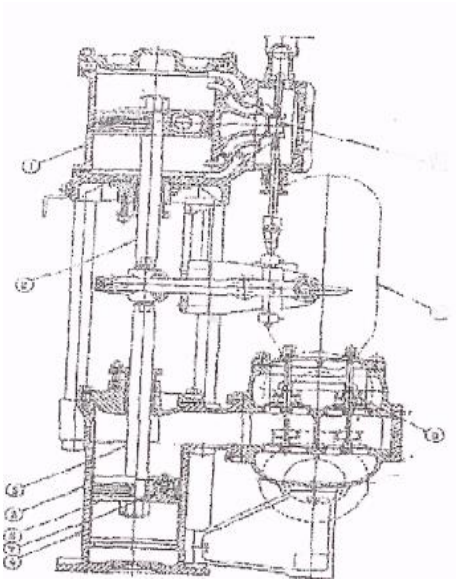
D) Injector Type Pumps

E) Screw Type Pumps

F) Submersible Type Pumps

1.14. A the Palindromic Type (Reciprocating Pump)

They are simple and powerful pumps which contain the ability of draining the pumps which is a huge advantage. Despite having such a great advantage their main drawback is the discharging rate, and for that specific reason they are used only at fat liquid, or like additional measures which aim the proper draining of the tank. This job cannot be performed by the vessel's main pumps (**Centrifugal Pumps**).Also they can assist the centrifugal pumps in the final stage of the discharging operation, when the level of the remaining cargo is low and we do not have proper suction. They are often used for the supply of water and air provision for cleaning the tanks after the completion of the discharging operation.



ΕΙΚΟΝΑ 16 PALINDROMIC TYPE PUMP

1.14.B Centrifugal Pumps

The centrifugal pumps transcend the palindromic pumps in many ways:

A) They provide much more cargo in less time.

B) They require less space and their installation is quite easier.

C) Their cost is less.

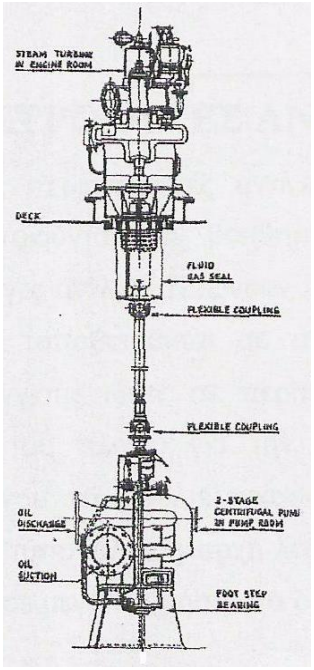
D) They are more trustworthy and require less maintenance.

E) They provide the cargo in a standard rate without raise or reduction.

F) They make less noise than the palindromic pumps.

G) The centrifugal pumps are located in the aft pump room, which gives them the opportunity to have boosts from the steam turbines & electric motors which are located in the Engine Room.

H) Discharging operations finish earlier



ΕΙΚΟΝΑ 17
CENTRIFUGAL PUMP

1.14. C Rotary Pumps

The Rotary Pumps aren't frequently among the discharging operations of Tanker Vessels. They are used as assisting drain pumps in vessels which have centrifugal pumps (1.14.B).They take their rotary move from an electromotor. They are usually placed as a combination with steam palindromic drain pumps, so in case there isn't any steam, they can face the vessel's difficulties when transferring ballast water, or when filling the tanks, in order to have a dry check inside the cargo holds. There are several types but their initiation is quite the same. The rotary pumps are not among the most used pumps in tankers because:

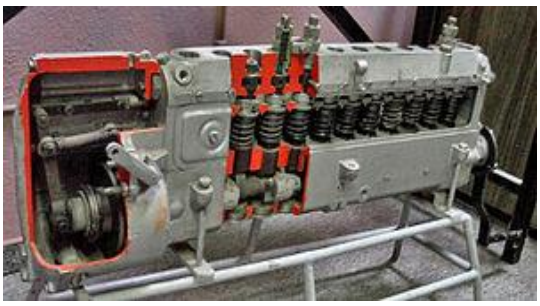
ΕΙΚΟΝΑ 18 ROTARY PUMP

A) Their moving parts suffer a lot of decay.

B) Those pumps tend to lose their suction when are used for a long period of time.

1.14. D Injector Type Pump

An Injection Pump is the device that pumps diesel (as the fuel) into the cylinders of a diesel engine. Traditionally, the injection pump is driven indirectly from the crankshaft by gears, chains or a toothed belt (often the timing belt) that also drives the camshaft. It rotates at half crankshaft speed in a conventional four-stroke diesel engine. Its timing is such that the fuel is injected only very slightly before top dead center of that cylinder's compression stroke. It is also common for the pump belt on gasoline engines to be driven directly from the camshaft. In some systems injection pressures can be as high as 200 MPa (30,000 PSI).



ΕΙΚΟΝΑ 19 INJECTOR TYPE PUMP

1.14. E Screw Type Pumps

The essential parts of the screw pump are three threads (screws) which are stationary and the middle is moving. The surfaces of the threads have such construction in order to form a leak-proof application together and entrap the liquid load in the gaps between them. As the movable coil is rotated about the axis, the trapped liquid load moves between thread gaps evenly to the outlet of the pump and continuously pushes a piston in a certain direction. The advantages of the screw type pumps are:

A) They never run out of suction

B) They have a silent application

C) They do not suffer any vibration even in excessive speed.

D) They have a steady rate of discharge without causing vibrations to the suction line of the cargo hold.

Despite their many advantage one disadvantage Screw Pumps have is to pump only liquid forms of cargo without any traces of impurities inside

ΕΙΚΟΝΑ 20 TWIN SCREW PUMP

1.14. F Submersible Type Pump

Submerged pumps are relatively common on chemical carriers. This type of pump is usually powered hydraulically or electrically and provides for a pump located in each tank. Manufacturer's instructions must be complied with for efficient operation of these pumps. Submersible pumps are purged, using inert gas (ship's IG or nitrogen) or air, as a means of checking for seal condition and tightness. The pumps must be purged before and after every loading/discharging/tank cleaning operation and the appropriate record form completed. If the purging records indicate a deviation from the manufacturer's recommended parameters, such as pump cofferdam is blocked or excessive seal leakage being detected, the management office is to be notified and appropriate corrective action is to be taken at the first opportunity.

1.14 F.A. Portable Submersible (Emergency) Pump

ΕΙΚΟΝΑ 21 SUBMERSIBLE PUMP IN OIL TANKERS

Portable submersible pumps, are provided on chemical ships and other specialized liquid cargo carriers, for discharging cargo in the event of a main cargo pump failure. The pumps are usually hydraulically driven and lowered directly into the tank generally through a tank cleaning hatch. All necessary safety precautions relevant to the actual cargo being handled are to be observed and permission obtained from the local port authorities before operations are commenced. It is a good practice to shut down the hydraulic oil pressure system before connecting and disconnecting hydraulic hoses of portable hydraulic driven emergency pumps.

Attention for the Discharging Operation of Dangerous Cargoes

1.15 Discharging Operation of Dangerous Cargoes

Nowadays after several incidents & accidents that occurred on ships which transferred dangerous cargoes, harmful for the environment, governments around the world tend to vote stricter legislations concerning both the transfer and the discharging operation of dangerous cargoes. When a port is frequently used the local authorities check for some specific precautionary measures before the initiation of the discharging operation:

A) The Master and the Vessel Officer who is in charge for the Discharging operation must be fully aware with the IMDCG Code (for the cargo loaded), to have an approved way of discharge and take under serious consideration that this dangerous cargo has been properly segregated.

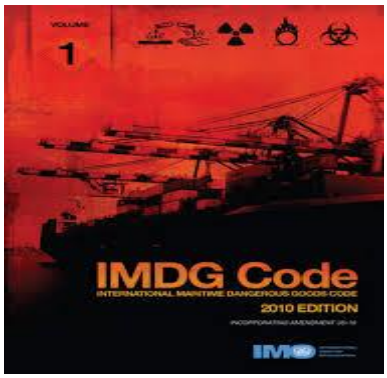
B) The proper stowage. We must be careful not to discharge in successive rows because pressure assists in the creation of risk. All the discharging operation must be kept away from the engine and boiler room. Also acids and generally dangerous cargoes liquid must be loaded on deck or near the mouth of hulls, if loaded into the hold, we should be able to easily control it and if necessary throw it overboard

C) Immediately remove the barges after their loading in places where permit unloading of dangerous cargoes downloaded. During loading and unloading take special security measures.

D) Smoking is strictly prohibited along with repairs which can most likely cause fire

E) In case of bad weather the unloading operation stops, the holds are secured.

F) The loading and unloading during the night is interrupted.



ΕΙΚΟΝΑ 22 BOOKLET FOR DANGEROUS CARGOES

G) During the day the ship puts a special red signal and during the night display special red lamp.

Attributes of the Discharging Operation of Container Vessels

ΕΙΚΟΝΑ 23 SHANGHAI THE WORLD'S BIGGEST CONTAINER PORT

In the last four decades the container as an essential part of a unit-load-concept has achieved undoubted importance in international sea freight transportation. With ever increasing containerization the number of seaport container terminals and competition among them have become quite remarkable. Operations are nowadays unthinkable without effective and efficient use of information technology as well as appropriate optimization (operations research) methods. Loading / discharging of containers is the handling by the Port of the containers between the stowage position onboard the vessel and the position in the Container Yard of the Port. No additional shiftings made based on any change in the information or additional information provided by the Line are included, and such addition nal shiftings made are chargeable as per Tariff. Import / Export containers pay Truck Loading / Unloading charge as per Tariff(Taken from an instruction manual for the discharging operation of containers)

1.16 Operational System for Container vessels

There are four main operational systems in the container terminal operation:

A) The ship operation

B) The quay transfer operation

C) The container yard Operation (including container storage and in-terminal movements),

D) The receipt/Delivery operation.

Where the terminal has a container freight station, there is also of course, a fifth operation: the CFS operation. The operation is, of course, the first set of activities in the discharge of import and other inbound containers, and the last stage in a loading operation, for exports and other outbound containers.

EIKONA 24 JEBEL ALI CONTAINER PORT

In the ship operation, quayside cranes are moved into position opposite the hatch and bay to be discharged or loaded, containers are lifted off and into the ship, hatch covers are removed and replaced, container securing systems are released and attached, container identification numbers and condition are checked as they are handled and so on. The operation is carried out by port workers located on board the vessel working above deck and (in some cases at least) below deck, others working on the quayside beneath the cranes (including the checkers or tally clerks), and the crane operators, of course, in their cabs

1.16.1 Lolo (Lift on Lift off) Operation Description for both Loading &Discharging

It is useful, when observing, analyzing and measuring the ship operation, to think of it is as consisting of a continuous, repeated sequence of crane movements, often called the crane cycle. Each cycle contains four activities. Let's identify those activities for a lift-on-lift-off (Lolo) operation, starting with outbound containers a ship loading operation:

A) First, the crane's spreader frame is attached to the container between the crane legs, as it sits either on a trailer or on the quay surface, where it has been placed by the quay transfer equipment.

B) Next, the crane lifts the container over the ship's rail to the appropriate cell guide or bay, and lowers the container into its chosen stowage position.

C) When the container is fully and correctly stowed, the spreader is released from the container.

D) Finally, the crane returns the spreader to the quayside, where the next container is already waiting to be loaded.

For an inbound container (discharge operation) the crane cycle's four stages are:

A) The attachment of the spreader frame to the container in its stowed position aboard the vessel;

B) Lifting and transfer of the container from its stowage position, over the ship's rail, to the quayside, to be lowered onto the waiting trailer or directly onto the quay surface (depending on the quay transfer system);

C) The release of the spreader, once the container is safely landed;

D) Finally, return of the spreader over the ship's rail to the stowage position of the next container to be discharged

1.16.1 A discharge sequence for Storo Operation

In a roll-on-roll-off (RoRo) operation there is, of course, no crane, so we cannot speak of a 'crane cycle' as the unit of ship operation activity. It is also in most cases difficult to distinguish separate stages in each operational cycle and to decide where the ship operation ends and quay transfer begins. However, it is possible to identify four steps in each cycle of one type of StoRo discharge sequence at least in the early stages of discharge:

A) The container (released from its lashings or other securing devices) is lifted from its place of stowage aboard the vessel by some form of lift-truck (typically a front-end loader).

B) The lift-truck transfers the container from its location below deck, via internal ramp(s) or lift(s) and the ship/shore ramp, to the quayside.

C) The lift-truck lands the container on the quay surface, to be picked up by the quay transfer equipment (e.g. a straddle carrier).

D) The lift-truck returns, via the ramp(s) and internal deck(s), to the stowage position of the next container.

1.16.2 Discharging of the Refrigerated Container from the vessel

After the refrigerated container has arrived at the port of discharge, the electric cord to the refrigerated container must be disconnected from the vessel power prior to discharging the container from the vessel. Special care should be exercised to avoid damaging the electric cord and/or the plug during the discharge operation. The refrigerated container must be drayed to the reefer section of the container yard "reefer pad" and immediately plugged in to shore side power. Once the reefer unit is connected to shore power, the set point temperature and fresh air exchange setting (vent setting) must be checked against the bill of lading information supplied by the shipping line. Any discrepancies in the set point temperature, the discharge and/or return air readings and/or vent setting must immediately be recorded and reported to the shipping line and corrected.

Many claims are filed because of the normal and customary "power off" phase between the unplugging of the refrigerated container from ship power prior to discharge and plugging in of the refrigerated container to shore power. Minimizing this power off phase to 4 hours or less will greatly reduce the filing of unwarranted claims. Shipping lines should confirm that there are standard operating procedures in place at the terminal to avoid the off-power events with the refrigerated container for no longer than 4 hours. Of note, microprocessor (data logger) and Partlow Chart temperature readings recorded during off-power events are generally not indicative of the cargo temperatures or the air temperatures within the cargo space.

ΕΙΚΟΝΑ 25 THE MECHANISM INSIDE A REFRIGERATOR CONTAINER

Once the refrigerated container is connected to shore power in the container yard, the set point temperature, the air delivery and return air temperature and the vent setting should be continually monitored and recorded every 6 hours while the container is in the yard and until the container is interchanged for picked up and delivery to onward destinations or final receivers via a feeder or line haul vessel, on- dock train or truck. The refrigerated part low chart should be removed and a new chart installed prior to interchanging the refrigerated container for subsequent truck, rail or ocean transport. Performance problems with the refrigerated container should be corrected as soon as possible while in the container yard. If an authorized reefer mechanic cannot repair performance and/or Technical problems with the refrigerated container in a timely manner, preparations should be made to transload (swing) the cargo into a properly functioning container. A marine cargo surveyor should be appointed to

inspect the condition of the cargo and container, document the cargo stowage and record cargo pulp temperatures at forward, middle and aft locations in the load. For refrigerated containers being loaded to feeder vessels, the shipping line must ensure that the set point temperature and vent setting is relayed to the feeder operator. If the feeder vessel cannot accept the refrigerated container either due to overbooking or late arrival, the shipping line should be notified and actions taken to prevent delay of the container at final destination. Options for reducing the delay of arrival at final or onward destinations should include loading the refrigerated container on another feeder vessel, booking the container with another carrier commonly known as a slot charter, surface transport by truck or rail or rolling the container to the next feeder vessel. Every effort should be made to avoid "rolling" refrigerated cargo. For containers being trucked or being loaded to on dock trains for transit to final or onward destinations, the shipping line must pass the set point temperature and vent setting information to the rail or truck operator.

Part II STOWAGE OF CARGO ON BOARD VESSELS

In shipping, the stowage factor indicates how many cubic meters of space one metric tone (or cubic feet of space one long ton) of a particular type of cargo occupies in a hold of a cargo ship. It is calculated as the ratio of the stowage space required under normal conditions, including the stowage losses caused by the means of transportation and packaging, to the weight of the cargo. The stowage factor can be used in ship design and as a reference to evaluate the efficiency of use of the cargo space on a ship.

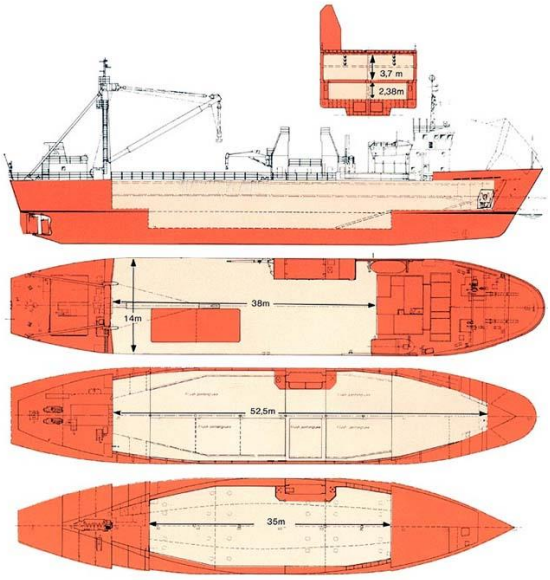
The stowage factor varies from one type of commodity to another — for example iron ore has a stowage factor of 0.40 (m3/MT), meaning that the space needed by one ton of ore is only one sixth of that required to stow one tone of woodchips that have a stowage factor of 2.5. This means that if a ship designed to carry woodchips is loaded with iron ore, only a small part of the hold capacity can be utilized, and a bulk carrier designed to carry iron ore cannot be loaded to the maximum draft with woodchips, leaving much of its deadweight tonnage unutilized. Thus the stowage factor is taken into account in ship design when determining the size of cargo holds, and specialized ships such as ore carriers and car carriers are built for cargoes with a stowage factor that departs significantly from the average

The stowage factor also depends on the type of packaging, being the lowest for unpackaged bulk cargo. While most commonly used for dry bulk cargo, a stowage factor can also be calculated for liquid bulk cargo and other commodities such as containers or cars.

2.1 Stowage of Different kinds of cargo:

2.1.1 Stowage of Palletized Loads

Palletized unit loads are formed on general-purpose four-way entry pallets. A palletized unit load may not be more than 52 inches long, 43 inches wide, and 54 inches high (including the pallet). The gross weight may not exceed 3,000 pounds. The cargo may overhang the pallet no more than 2 inches on each end and 1 l/2 inches on each side and the palletized unit load will occupy approximately 70 cubic feet of shipping space. The cargo and pallet are securely bound together with adhesives and/or various types of banding. A common method is to use five steel straps around both cargo and pallet. Two are spaced equally and placed longitudinally, and three are spaced equally and placed transversely.



ΕΙΚΟΝΑ 26 VESSEL FOR PALLETIZED CARGO STOWAGE

When a small number of palletized loads are stowed, the best location is the square of the batch. However, if the volume of palletized cargo is great, it must be stowed in the ends and wings. Unlike heavy lifts, pallets are not designed for dragging. Although pallets can be dragged into the wings and ends, dragging is time-consuming and dangerous and causes excessive damage to the cargo. The following methods are recommended for placing palletized cargo in underdeck stowage:

A) Place the required dunnage in the hatch. Usually little dunnage will be necessary since the pallet itself serves as dunnage, but some dunnage may be needed for leveling off, padding obstructions, and so forth.

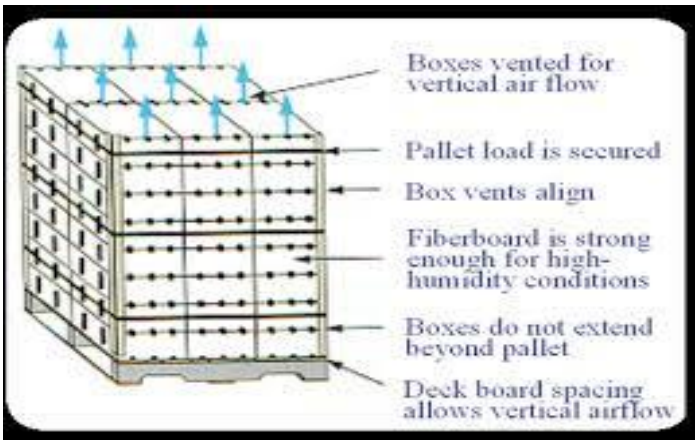
B) Hoist a forklift into the hatch. Short-mast, pneumatic-tired forklifts should be used.

C) Place the pallets in the hatch so that the access slots face in a direction requiring a minimum of forklift maneuvering. Using the forklift, engage the load and proceed to the place of final stowage.

D) If pallets cannot be tiered under the deck because of insufficient headroom clearance, it is often possible to load one pallet on top of another in the square of the hatch and move both pallets into the final stowage position with the forklift.

E) Use filler cargo or chocking to take out the sheer at the bottom of the hatch and to fill in any voids created by the shape of cargo, stanchions, or other fittings. Filler cargo must be of a type that will not be easily damaged.

F) If it is necessary to operate a forklift on top of unitized cargo, dunnage off the entire hatch with two layers of dunnage, one fore and aft and one athwart ship, making floors solid.



ΕΙΚΟΝΑ 27 PALLETIZED CARGO

Pallet jacks may be used to move palletized cargo into final stowage position under deck. Since pallet jacks cannot tier cargo, it will be necessary to stow one tier at a time. Dunnage must be laid between views so that the pallet jacks can be maneuvered. Palletized cargo may be moved into final stowage position by roller conveyors. The roller conveyors are laid from the square of the hatch to the stowage position. The draft is landed on the conveyors and rolled into position. Conveyor sections must be lifted after each draft. One section of roller conveyor can be inverted so that the rollers are next to the deck or dunnage. The conveyor is spotted so that it is pointing in the direction of stowage. The draft is landed on the inverted conveyor and rolled into stowage position. The draft must be lifted so that the conveyor can be removed. The truck dolly or pallet dolly may also be used in the same manner as the inverted roller conveyor. Palletized cargo may be moved into final stowage position by means of wooden or metal single-type rollers.

2.2 Stowage of Heavy Lifts

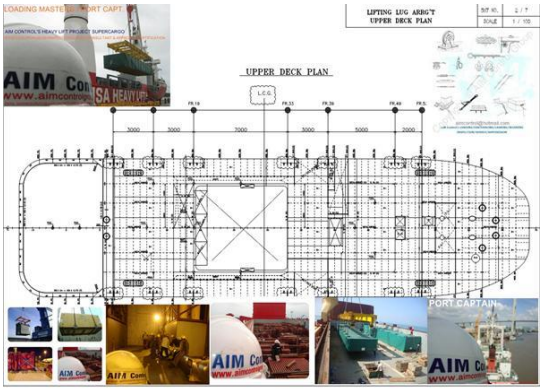
The stowage of heavy lifts, such as tracked vehicles, takes place every day in terminal operations. A heavy lift is any single package, pallet, unitized or containerized item that weighs 10,000 pounds or more.

1) Before heavy lifts are loaded, cargo handlers should prepare the holds to receive the cargo. Dunnage material should be assembled for securing the lifts, blocks, shackles, draglines, bars, and other necessary equipment beforehand. This material should be loaded into the hold before the first lift is hoisted aboard.

2) Cargo handlers should check all gear before picking up a heavy lift.

3) Cargo handlers must use taglines on all heavy lifts. All personnel must stand clear of a heavy lift coming into the hatch until it is lowered to within a few inches of the deck. Personnel can then assist in steadying the lift for landing.

4) Operators can move tracked vehicles, such as tanks, crawlers, cranes, and bulldozers from the square of the hatch to their stowage position by draglines.



EIKONA 28 DESIGN OF A VESSEL ESPECIALLY FOR HEAVY CARGO LIFTING

2.2.1 Stowage of Heavy Cargo (Trucked vehicles)

The tracks are barked or released to control the movement and direction of the vehicle. Only experienced operators of heavy equipment are permitted to steer tracked vehicles. When stowing tracked vehicles in the hold, cargo handlers will:

- Stow tracked vehicles in a fore-and-aft position, whenever possible.
- Leave multifuel vehicles in neutral gear with the brake engaged.
- Leave gasoline-driven vehicles in gear with the brake engaged.
- Lock turrets on tanks, and cabs on cranes, or lash them in position.

Also additionary measure A): double solid floor of planking not less than 2 inches thick must be constructed and nailed down before tanks, bulldozers, or cranes are loaded. When tanks are stowed in the between deck, similar flooring is laid. Operators should secure tracked vehicles weighing less than 18 tons with at least 4- by 6-inch lumber. Those vehicles weighing more than 18 tons should be secured with at least 6- by 8-inch lumber. Cargo handlers should lash all tracked vehicles, whether stowed on deck or below deck, with wire rope or chain.

B) Use vehicle bridles and slings to hoist wheeled vehicles aboard ship. These vehicles are landed in the hold to head in the direction of stowage. After they are landed, one person releases the brake and steers the vehicle while it is pushed into stowage position. If the vehicle cannot be pushed into position by hand, a dragline is set up. If it is necessary to move one end of the vehicle sideways to stow it in the desired spot, use one of the following methods:

C) Place dunnage smeared with skid compound or grease under the wheels on the end of the vehicle to be moved. Dunnage is laid in the direction of the move. Operators set up a dragline and the ends of the vehicle are dragged to the desired spot.

ΕΙΚΟΝΑ 29 STOWING THE TRUCKS

D) Use heavy-duty rolling jacks to move the end over, if available.

E) Operators will stow vehicles fore and aft whenever possible. As in the case of tracked vehicles, stowing them fore and aft lessens the chance that they will break loose when the ship rolls in heavy seas. When it is necessary to stow them athwart ship, you should obtain permission from the vessel's master or representative. When securing vehicles stowed athwart ship, cargo handlers must set the brakes on the vehicle.

F) Block the vehicle at both sides and at both ends so that it cannot move in any direction. The size and type of vehicle will dictate the size of timber to use.

G) Brace individual vehicles to bulkheads, stanchions, or other vehicle blocking.

H) Use lashing in addition to blocking and bracing. Vehicles must be lashed with wire rope. Put blocks under bumpers or chassis to keep tension off the springs

2.3 The procedures for protecting, loading, and stowing bagged cargo

The procedures for protecting, loading, and stowing bagged cargo are listed below:

A) To prevent water damage, bagged commodities, such as cement, should be stowed away from moist cargo or cargo that sweats. Bags also must be protected from any direct contact with metal. Use mats, paper, or other protective material to protect the cargo from moisture running down the ladders, frames, stanchions, and so forth. When bagged cargo is loaded aboard a vessel on which no dunnage is used between the bags and wooden cargo battens, the bags should be stowed on their ends in the wings of the

ship. This will prevent them from protruding over the battens and coming in contact with the moist metal of the hull plating.

B) Do not allow the bags to overlap the stringer plates of beams or similar obstructions in the hold. If the bags are allowed to overlap, vessel motion could cut them. Vertical dunnage placed against ladders and hatch battens will normally protect the bags from falling or chafing. Cargo handlers should never use handbooks to handle paper-bagged cargo.

C) Bagged cargo is stowed in tiers across the hold (Figure 8-4). Cargo handlers may use any of the following three general methods for stowing bagged cargo:

- The full bag method provides good ventilation but provides an unstable stow. Unless required for some reason, this is the least desirable method of stowing bagged cargo.
- The half-bag method is used where floor ventilation is not important and bags are soft.
- The cross-tier method is used at corners and outer rows to prevent collapsing or shifting of the stacks of bagged cargo.

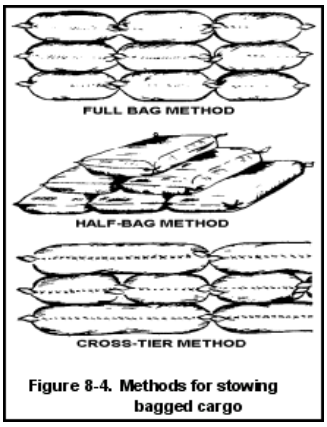


Figure 8-4. Methods for stowing bagged cargo

D) Figure 8-5 shows a typical stowage of bagged cargo. Dunnage around the ladder protects the bags. The bulkhead prevents shifting, and the cross-tier method of stowing prevents collapsing

2.3.1 Handling – Stowing Baled cargo

The procedure for handling baled cargo is listed below:

A) Baled cargo is easily damaged by chafing. To prevent chafing, use flat board dunnage underneath bales since dunnage with sharp edges would cut through the bale wrappings.

B) Dunnage all metal parts in the hold to prevent damage from moisture.

C) Bales stowed in the wings of the hold are frequently placed on end so that only the outside layers of cargo will be damaged if moisture condenses on the sides of the ship or should chafing damage the bales.

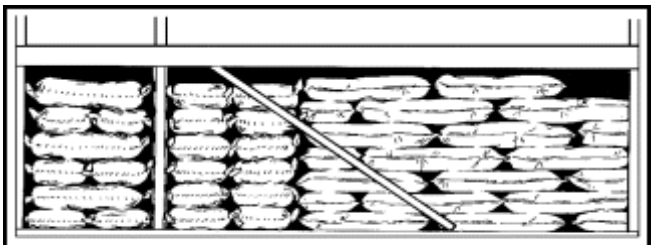


Figure 8-5. Typical stowage of bagged cargo

2.4 The Stowing procedure of Cased goods

The procedures for stowing cased goods are listed below:

A) Strong wooden cases of uniform size may be stowed brick fashion, in the same way as cardboard cartons. No dunnage floors are placed between the tiers in the lower hold.

B) When stowing cased goods, cargo handlers must:

- Stow heavier cases in the lower tiers.
- Never stow a case so that it rests directly on top of and inside the four corners of the case beneath it unless dunnage is laid across the top of the lower case to take the weight.
- Stow cases containing cargo that might leak separately or at the bottom of the hold.
- Make every possible effort to keep ties level. This can often be achieved by filling up the spaces between large cases with smaller cases.
- Place dunnage over lightly constructed cases before the next tier is started.

2.4.1 Stowage of Crates

ΕΙΚΟΝΑ 30 STOWING CRATES AT THE PORT OF CHONGQING

Crates are lightly constructed containers built as a framework with open sides and tops. They are used for ocean shipping and are stiffened by the use of diagonal pieces of lumber. The bottoms are solid with well-built foundations that support their internal weight. When crates are stowed, tiers should be kept level by laying dunnage between them. The dunnage may be spaced about 4 inches apart. Crates should be stowed in the tween decks or in the top tiers of the lower holds. If it is necessary to stow cargo over crates, only lightweight cargo should be used.

2.4.2 Stowage of Drums

Drums are made of steel. They are stowed athwart ship and upright with the bungs up.

A) To prepare the hold for stowing drums, cargo handlers-Lay dunnage athwart ship approximately 6 inches apart on the deck and place drums on the dunnage. Build a shelf over the turn of the bilge Place dunnage between the first row of drums and the bulkhead.

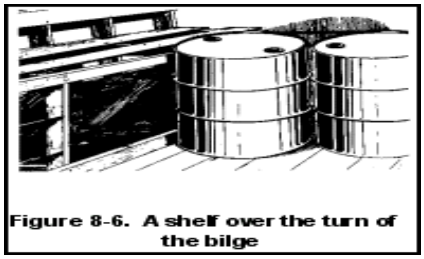


Figure 8-6. A shelf over the turn of the bilge

B) To stow the first tier or from the wings to the center of the hold. Rest chimes squarely on the dunnage. If the first row does not fit securely across the bulkhead, save space by spreading out the drums, keeping equal space between them. Stagger the next row of drums (keeping the same spacing as in the first row). The second row should fit into the recessed areas created by the slight spacing between the drums in the first row.

C) To stow the second tier, cargo handlers should-Lay dunnage over the first tier. Place drums on dunnage

D) Cargo handlers will stow succeeding tiers in the same way.

NOTE: The drums must never be stowed more than three tiers high, otherwise accidents may be caused

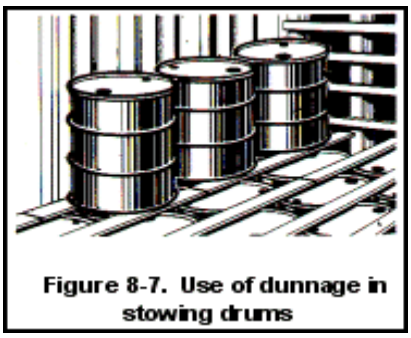


Figure 8-7. Use of dunnage in stowing drums

2.5 Stowage of Lumber

Lumber is shipped in loose board lots and packaged lots. Cargo handlers should plan carefully to reduce lost space in handling packaged lumber. Large voids can be filled in with loose boards as necessary. Besides pulpwood, rough lumber is the raw material for furniture-making and other items requiring additional cutting and shaping. It is available in many species, usually hardwoods. Finished lumber is supplied in standard sizes, mostly for the construction industry, primarily softwood from coniferous species including pine, fir and spruce (collectively known as Spruce-pine-fir), cedar, and hemlock, but also some hardwood, for high-grade flooring.

ΕΙΚΟΝΑ 31 LUMBER STOWAGE

A) Lumber may be stowed on deck or below deck. Deck loads of lumber must be securely lashed. The use of 3/4-inch chain made fast to pad eyes on deck and secured with turnbuckles, pear links, and slip hooks on top of the cargo is a suitable method of lashing. Chain lashing should be spaced no more than 10 feet apart.

ΕΙΚΟΝΑ 32 TIMBER STOWAGE ON A CRANE BULK CARRIER

B) When finished lumber is being loaded, cargo handlers should use manila rope slings for hoisting. Hooks should never be used on finished lumber. If it is necessary to use wedge point bars to stow lumber, dunnage should be placed between the bars and lumber. When hoisting lumber, two slings should be used. If only one sling is used, the boards on the inside of the load may slip out, damaging cargo and injuring personnel. Lumber may be unitized for easier handling by making up drafts of uniform size and banding the cargo so that each draft is handled as a single quantity.

2.6 Stowage of Cylinders

Strong steel cylinders are used for the shipment of compressed gases. These containers are under pressure of up to 2,000 pounds or more per square inch. Cargo handlers must handle these containers carefully and stow them securely to prevent damage to the cylinder. If damaged, the cylinders could cause damage to other cargo, as well as to the ship.

A) Equipment used for loading or unloading compressed gases must be adequate to prevent cylinders from falling during handling operations. Use a tray with sideboards of sufficient height to prevent cylinders from falling off, a tray with small mesh net, a pallet with cylinders secured in place, a bridle, or a bridle sling with a round twin at each end of the load.

B) Stowed instructions for each specific type of compressed gas are contained in paragraph 146.24-100 of the CFR.

C) When CFR paragraph 146.24-100 permits on-deck stowage, the vessel master must approve the method. Cargo handlers should ensure stowage is consistent with the following conditions:

- The vessel must have open spaces on deck suitable for this stowage.
- Sufficient structural protection must be provided by the vessel's freeboards or bulwarks.
- Cylinders must be stowed on their sides unless boxes, cribs, or racks are provided for vertical stowage.
- When stowed on deck, the cylinders must be protected from the direct rays of the sun by awnings or other protective structures. Tarpaulins covering and in contact with cylinders are not considered adequate protection. Use of wood dunnage is permitted for protection.

D) Cylinders stowed under deck must be placed in cool compartments or holds that can be ventilated or are of gastight construction. These compartments should be protected from open flame and any source of artificial heat. They must contain no living spaces for crew and passengers, and be readily accessible from hatches or cargo holds.

E) Cylinders of compressed gas stowed either on deck or under deck will be kept from direct contact with the vessel's sides or bulwarks by dunnage, shoring, or other effective means.

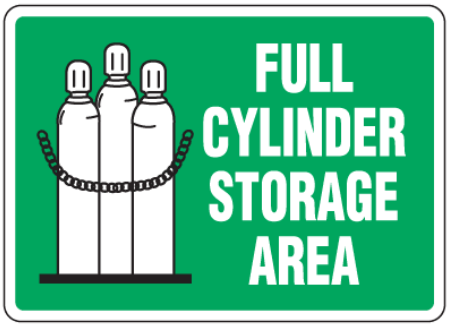
F) Cylinders of compressed gas stowed on their sides must be dunnaged under the first tier so that they will not rest directly on a steel or iron deck. Cargo handlers should stow each additional tier in the cant lines of the lower tier. Never stow cylinders bilge-to-bilge or directly on top of one another. The tiers may be stepped back and the ends of the cylinders alternated in order to clear the flange. Suitable lashing must be provided to prevent movement in any direction.

G) When cylinders are stowed in a vertical position, they must be stowed in a block and cribbed or boxed in with suitable sound lumber. Cargo handlers will dunnage the box or crib at least 4 inches off the steel or iron deck. The cylinders in the box or crib should be braced to prevent any movement. The box or crib should be securely chocked and lashed to prevent movement in any direction.

H) Lashing must be secured to pad eyes or other structural parts of the vessel. Pipe rails should not be used to secure lashings.

I) the cylinder valves are protected by screw caps recessed into the cylinder. When personnel handle cylinders, they must ensure these screw caps are on and the valves are protected as much as possible. Rough handling may cause a valve to break and result in a serious accident. The

uncontrolled escape of compressed gas will cause the cylinder to take flight, sometimes with enough force to blow it through the side of a ship.



J) Open flame lights and-smoking are prohibited near flammable compressed gases. Responsible personnel will ensure that "No Smoking" signs are posted in the vicinity of such gases. Flammable gases may not be stowed below deck or on a vessel with Class A or Class B explosives, unless separated from the explosives by the engine or boiler rooms.

2.7 Stowage of Refrigerated/Frozen/Chilled Cargo

2.7.1 Stowage of Refrigerated Cargo

Stowing refrigerated cargo does not differ greatly from that of general cargo, except that refrigerated cargo requires more care with temperature and ventilation and normally is not palletized. Foods having a strong odor should not be mixed with those having a tendency to absorb odors. All cargo compartments must be at the prescribed temperature before loading to prevent refrigerated cargo from thawing or spoiling. Perishable cargo is divided into three general classes: frozen, chilled, and air-cooled cargo.

ΕΙΚΟΝΑ 33 STOWAGE OF REFRIGERATED CARGO

Food products comprise the majority of refrigerated cargo, although other commodities such as medicines, drugs, and certain temperature-sensitive chemicals are often transported in this manner. Items shipped under refrigeration cannot withstand long periods of exposure to normal outside air temperature or other conditions that might result in deterioration and ultimate loss of a commodity. This applies whether the cargo is loaded in containers or is transported by conventional break-bulk stowage in the ship's refrigerated cargo spaces.

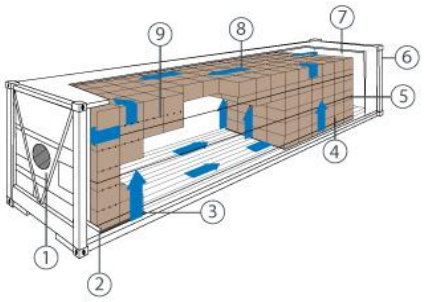
Containerization is a very effective method of transporting refrigerated cargo. Continuous refrigeration between point of origin and destination and the elimination of multiple handling required in conventional break-bulk shipments have drastically reduced in-transit damage and loss of these products. The advantages of one handling

at point of loading and point of discharge are especially apparent when compared to the conventional cargo system with its multiple handlings:

a. from warehouse to rail,
b. to truck,
c. through the terminal and aboard ship,
d. discharge at port as destination, and
e. Reloading again to truck or rail for final delivery.

Each handling is labor intensive, increases the potential for damage and loss, and interrupts the refrigeration process.

2.7.2 Stowage of Frozen Products



EIKONA 34 A MODIFIED CONTAINER DESIGNED TO TRANSPORT FROZEN PRODUCTS

Frozen cargo that is received by the terminal for containerizing or for loading aboard a break-bulk ship must be closely checked. The schedule for the receiving of frozen cargo must be closely coordinated with the loading operation. Ideally, the cargo should be received in lots that can be handled effectively without extended exposure to normal air temperatures. If cargo is received in larger quantities than can be immediately handled, it is customary for the delivering truck to wait, with its reefer unit in operation, so that the cargo will be kept at the proper temperature. When receiving the cargo it is also good practice for the receiving clerk to record the temperature of the reefer unit on the delivery truck, as well as take the temperature of the product. The instantaneous response of a probe or spike thermometer can be used to indicate temperature differences over time and within locations of contents in the container. If an initial high reading is obtained, the clerk inserts the spike into another area to confirm or correct the reading. Frozen meat should not be accepted if the temperature is above -10oC. If such a condition exists, the shipping contractor should be immediately contacted for a decision regarding the deposition of the cargo. Sometimes the cargo must be taken to a local reefer warehouse, where it will be "flash-frozen" to the required level.

Although the reefer units in these containers are designed to hold cargo at a specific temperature, they are not powerful enough to freeze effectively any cargo that was not initially frozen. A frequent defrost cycle record is another indication that the cargo may not have been properly frozen. Reefer units, like home refrigerators, have automatic defrosters which activate when the coils become heavily frosted. If this happens at short intervals, it is an indication that the unit may be overworking. It is important, therefore,

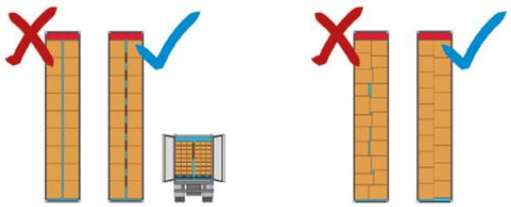
to make periodic checks to verify that the temperature is gradually dropping to the required degree. If it does not drop, or drops very slowly, the shipping contractor should be notified. When notified, the shipping contractor may direct that the doors of the container be opened and an inspection be made to determine whether the container was properly stowed and whether sufficient ventilation space was left over the top of the cargo and in the door area.

ΕΙΚΟΝΑ 35 FROZEN PRODUCTS CARRIED ON SHIPS

2.7.3 Stowage of Chilled Cargo

A) The stowage of fruits and vegetables under refrigeration is much more complex than that of frozen products. Studies have been made over many years to establish the best condition for the preservation of fruits and vegetables, and these conditions must be specified by the shipper for the produce being transported. Each category of fruit and vegetable, for example, has characteristics which may dictate a difference in the carrying temperature, ventilation requirements, and stowage.

B) Most reefer containers have an adjustable ventilation window adjacent to the reefer unit. This window can be set for 0 to 100 percent ventilation, according to shipper's instructions. Thus, outside air can be introduced through the cooling system in a specified amount and the gases generated by the produce expelled from the container. To provide the necessary space for air circulation, it is usually the practice to use wood stripping or lathes between every other tier in stow. "Smokestack stowage," which involves stowing tiers of packages in a square pattern so that there is an empty "chimney" space in the center of the square, is sometimes used to increase vertical ventilation. This method, however, can result in loss of space in the container. Container construction may also affect storage space. Many containers, for example, have a line painted near the ceiling to indicate the maximum height to which cargo can be stowed. Other containers have an air duct running along the center of the ceiling, which must not be blocked by cargo. Container sides are usually ribbed to provide an air space between the skin and the cargo. The floor is constructed with small "I" beams, which are perforated to supply a clear airflow along the floor beneath the cargo.



ΕΙΚΟΝΑ 36 HOW CHILLED PRODUCTS ARE STOWED INSIDE A REFER CONTAINER

C) At times it may be necessary to stow different commodities together. This may or may not be safe. Fresh fruits can generally be stowed together if they have the same temperature requirements. With some products, however, there is a cross-transfer of

odors, and some products emit volatile gases, such as ethylene, that may be harmful to other products. Some general rules of storage follow:

- Do not store apples or pears with celery, cabbage, carrots, potatoes, or onions.
- Do not store celery with onions or carrots.
- Do not store citrus fruits with any strongly scented vegetables.
- Odors from apples and citrus fruits are readily absorbed by meats, eggs, and dairy products.
- Pears and apples acquire an unpleasant earthy taste and odor when stored with potatoes.
- It is recommended that onions, nuts, citrus fruits, and potatoes each be stored separately.

Apples, pears, bananas,avocados, peaches, plums, cantaloupes, ripe honeydew melons, and tomatoes are among the fruits and vegetables that give off ethylene gas, which can be harmful to other items such as lettuce and carrots.

EIKONA 37 SALICA FRIGO A REFER VESSEL

Conclusion/Synopsis

This assignment focus on two great factor of the shipping industry. Firstly by examining all the discharging operations vessels possess regardless of their type (bulk carrier, RoRo, container vessel, oil-chemical-crude oil tanker), and by pointing the equipment required to perform such an operation. Attributes of the equipment and way of performance is examined and presented thoroughly.

After the completion of the first part (Discharging Operation) the assignment focuses on the part of Cargo Stowage which is of vital importance for the safe receipt and delivery to the intended port of call. As mentioned before all types of vessels are included in the stowage department by presenting the special features each vessel type possesses in the stowage operation.(Refer Vessels, Tankers, Oil Tanker, Bylk Cargo)

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