2ND MATE (F.G.) – MMD ORALS EXAMS NOTES BASED ON FREQUENTLY ASKED QUESTIONS

FUNCTION 2

Last Updated Feb'23

BROKEN STOWAGE

Broken Stowage:
Broken stowage is the term used to describe the unused spaces or gaps left in a cargo hold after the stowage of cargo. It refers to the loss of space that results from the irregular shape of cargo, such as when containers or other cargo units do not fit perfectly into the space available. This can lead to inefficiencies in cargo transport, as the unused space represents a loss of potential revenue. To minimize broken stowage, careful planning and stowage is required to ensure that all available space is used efficiently.

LIFTING GEARS

What all you will check after receiving stores of wires/ ropes etc.?
After receiving stores of wires/ropes, the following checks should be carried out:
- Quantity and size: Check that the quantity and size of the wires/ropes received matches the order and specification.
- Quality: Inspect the wires/ropes for any visible defects such as kinks, twists, cuts, or other damage that may affect their strength.
- Manufacturer's markings: Check that the wires/ropes are marked with the manufacturer's name or trademark, the type of material, and the size.
- Certification: Check that the wires/ropes are certified by a recognized classification society or testing agency.
- Storage conditions: Check that the wires/ropes have been stored in appropriate conditions and have not been exposed to excessive heat, moisture, or other damaging conditions.
- Documentation: Check that the appropriate documentation, such as a certificate of conformity or test report, is provided with the wires/ropes.
- Handling and transport: Check that the wires/ropes have been handled and transported in a manner that does not cause damage or affect their performance.

By carrying out these checks, you can ensure that the wires/ropes received are of the correct quality and specifications and are safe to use on board the vessel.

Types of Derricks:
1. Jib Derrick: Also known as a boom derrick, a jib derrick consists of a single boom or spar that is pivoted at its base and attached to a mast or kingpost. The boom can be raised or lowered using a topping lift, and the load is handled using a cargo runner. Jib derricks are simple and widely used for general cargo handling on ships.
2. Stiff-leg Derrick: A stiff-leg derrick has a fixed boom, which is supported by two or more non-adjustable legs or spars that extend from the base of the derrick to the boom's head. This type of derrick offers increased stability and capacity, making it suitable for heavy lifting operations on ships.
3. Guy Derrick: Guy derricks have a single boom supported by multiple guy wires or ropes that extend from the boom's head to various points on the ship's structure or deck fittings. The guy wires provide lateral support and stability to the derrick, allowing it to handle heavier loads on ships.
4. Samson Post Derrick: A Samson Post derrick features a strong vertical post, with the boom pivoted at the base of the post. The topping lift is connected to the top of the Samson post. This type of derrick is robust and commonly used on small vessels and workboats.

Union Purchase Derrick:
A Union Purchase Derrick is a cargo handling system that employs two derricks rigged together, with their heads attached to a common lifting hook. This arrangement enables the derricks to work in tandem, allowing them to lift heavier loads than they could individually. The Union Purchase Derrick system is particularly useful for lifting large or heavy items, such as heavy machinery or large containers, onto or off a vessel.
To set up a Union Purchase Derrick system, the two derricks are positioned so that their booms intersect at an angle. The head of each derrick is connected to the common lifting hook, which is attached to the cargo. The angle between the derricks and the geometry of the rigging provides increased lifting capacity by distributing the load between the two derricks. The lifting operation must be carefully coordinated to ensure that the load remains stable and that the derricks are not subjected to excessive stress.

Parts of Union Purchase?
A Union Purchase rig, also known as a Union Purchase Derrick system, consists of two derricks rigged together to work in tandem for lifting heavy loads. The main parts of a Union Purchase system are as follows:
1. Derricks (2): Two derricks, which can be either fixed or movable, are the primary components of the Union Purchase system. Each derrick has a boom and a mast or kingpost, with the boom pivoted at the base.
2. Topping Lifts: Topping lifts are the ropes or wires connected to the boom's head, supporting the weight of the boom and adjusting its angle relative to the mast or kingpost.
3. Guys: Guys are the ropes or wires used to support and stabilize the derricks laterally. They are connected to the derrick's head or boom and extend outward to various points on the ship's structure or deck fittings.
4. Cargo Runner: The cargo runner is the main lifting wire or rope that runs from the winch or hoisting mechanism through blocks on the derrick heads and connects to the common lifting hook.
5. Common Lifting Hook: The common lifting hook is the point where the cargo runners from both derricks converge. The cargo is attached to this hook for lifting.
6. Winches: Winches are used for hoisting and lowering the load. They provide the mechanical power for the cargo runner, topping lifts, and guys. Each derrick may have its own winch, or a single winch may be used with a system of blocks and tackle to control both derricks.
7. Blocks and Tackle: A system of blocks (pulleys) and tackle (ropes or wires) is used to distribute the load between the two derricks, control the movement of the cargo, and provide mechanical advantage for the hoisting and lowering operation.

When using a Union Purchase system, the derricks' booms intersect at an angle, and the system is rigged to evenly distribute the load between the two derricks. This arrangement increases the overall lifting capacity and allows the handling of heavier or bulkier loads than a single derrick could manage. Proper coordination and communication between the crew members are essential to ensure a safe and efficient lifting operation.

Marking of Gears:
Gears used on board ships for various machinery systems and equipment are marked with specific details to ensure their correct installation and usage.
The following are some of the common markings found on gears:

- Pitch diameter: The diameter of the circle that passes through the center of the gear teeth.
- Diametral pitch: The number of teeth per inch of the pitch diameter.
- Face width: The width of the gear measured parallel to the axis.
- Pressure angle: The angle between the line of action and a line tangent to the pitch circle.
- Helix angle: The angle between the gear teeth and the gear axis.
- Module: The ratio of the pitch diameter to the number of teeth.
- Gear ratio: The ratio of the number of teeth on the driven gear to the number of teeth on the driving gear.
- Heat treatment mark: Indicates the type of heat treatment that the gear has undergone.
- Material mark: Indicates the type of material that the gear is made of.
- Manufacturer's mark: Indicates the manufacturer of the gear.
- Serial number: A unique number assigned to the gear for identification and tracking purposes.

These markings help in identifying and selecting the right gear for a particular application, ensuring that the gears are correctly installed and operated, and in maintaining an accurate inventory of the gears on board the ship.

INERTING

Inert gas pressure while discharge:
During cargo discharge, the inert gas system on board the ship is used to maintain a positive pressure in the cargo tanks to prevent the ingress of air which may lead to cargo contamination or explosion. The required pressure is typically maintained between 20-50 mbar above the atmosphere pressure. The pressure level is checked and monitored regularly by the ship's crew to ensure that it is maintained within the required range. If the pressure drops below the desired level, the inert gas supply is increased to restore the required pressure. On the other hand, if the pressure rises too high, the excess gas is vented out to maintain the pressure within the desired range.

Inert Gas Oxygen content:
The oxygen content of the inert gas is measured using an oxygen analyzer or oxygen sensor, and is maintained below 8% by volume. The exact target oxygen content may vary depending on the type of cargo being carried and relevant regulations. Regular monitoring and recording of the inert gas oxygen content is necessary to ensure safe operation.

Gasoil hazards:
Gasoil, also known as diesel oil or marine gas oil (MGO), can pose several hazards on

board a ship, including:
1. Fire hazard: Gasoil is highly flammable and can easily catch fire if it comes into contact with a source of ignition. It is important to store gasoil in designated areas away from sources of heat, sparks, or flames.
2. Toxicity: Gasoil can release harmful fumes and vapors that can cause respiratory problems or even death if inhaled in large quantities. It is important to follow proper ventilation procedures and wear appropriate personal protective equipment when handling or working around gasoil.
3. Environmental hazard: Gasoil can be harmful to the environment if it is spilled or leaked into the water. It can cause pollution and harm marine life. It is important to follow proper procedures for handling, storing, and disposing of gasoil to minimize the risk of environmental damage.
4. Health hazard: Exposure to gasoil can cause skin irritation, eye irritation, and other health problems. It is important to handle gasoil with care and wear appropriate personal protective equipment to minimize the risk of exposure.

LEL: LEL stands for Lower Explosive Limit. It is a term used in the field of occupational safety and health to describe the lowest concentration of a combustible gas or vapor in the air that can create an explosion or fire when it comes in contact with a source of ignition.

LEL is typically expressed as a percentage of the gas or vapor in the air by volume. For example, the LEL of methane is 5%, which means that an atmosphere containing 5% or more methane gas in the air can be considered to be potentially explosive.

LEL is an important safety consideration in industries where flammable gases or vapors are present, such as oil and gas production, chemical manufacturing, and mining. Workers must be trained to monitor LEL levels and take appropriate precautions to prevent explosions or fires, such as proper ventilation, the use of explosion-proof equipment, and the use of personal protective equipment.

Critical dilution with air (flammability diagram) and where is it useful?
Critical dilution with air is the process of reducing the concentration of a flammable gas or vapor in the air by diluting it to a level where it is no longer capable of igniting or causing an explosion. To better understand this concept, we need to consider the flammability diagram, also known as the flammability triangle or the explosion triangle.

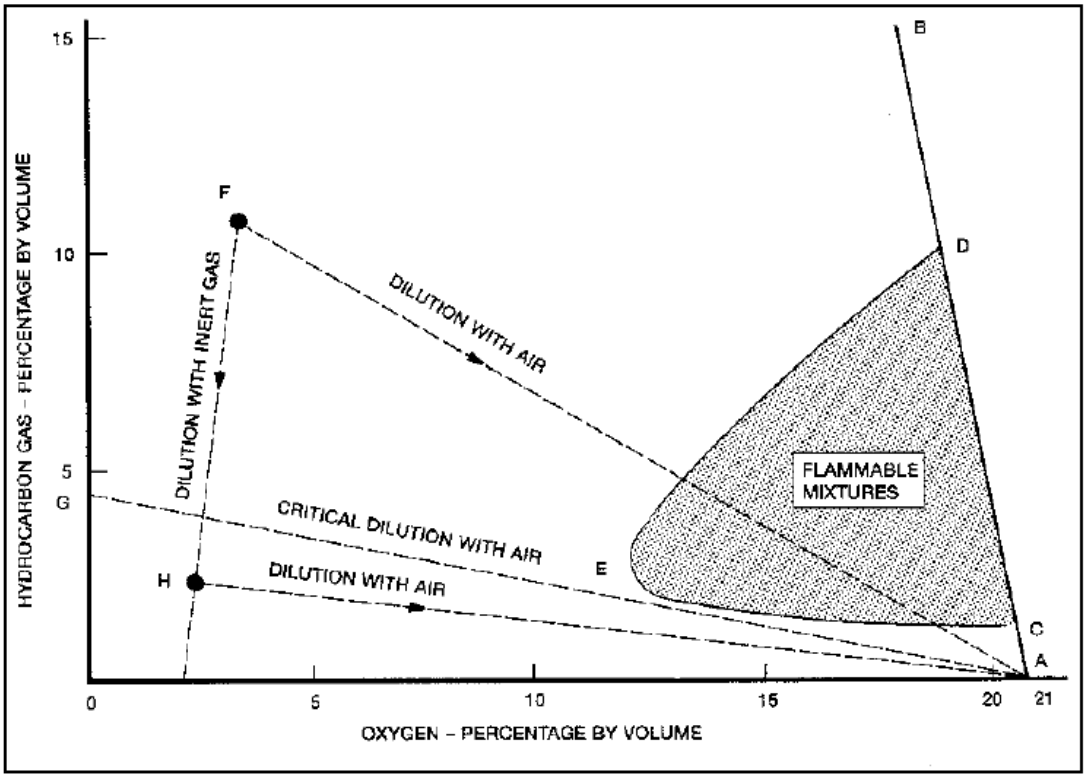

Figure 2.1 Flammability Composition Diagram – Hydrocarbon Gas/Air/Inert Gas Mixture

A flammability diagram represents the relationship between three key elements required for a fire or explosion to occur: fuel (flammable gas or vapor), oxygen (typically from the air), and an ignition source (heat or a spark). The diagram is usually represented as a triangle, with each element at a corner. If any one of the three elements is missing or insufficient, a fire or explosion cannot happen.

A flammable gas or vapor has an associated flammable range, which is defined by its lower flammable limit (LFL) and upper flammable limit (UFL). The LFL is the minimum concentration of the gas or vapor in air that can support combustion, while the UFL is the maximum concentration beyond which the mixture is too rich to burn.

In a maritime context, critical dilution with air is essential for maintaining safety in areas where flammable gases or vapors may accumulate, such as cargo holds, pump rooms, and engine rooms. Effective ventilation systems and continuous monitoring of gas concentrations are crucial in achieving the desired level of dilution to prevent fires or explosions.

<u>Some areas where critical dilution with air is useful include</u>:
1. Cargo holds and tanks: Especially when dealing with flammable or toxic cargo, it is essential to maintain safe concentrations of gases by diluting them with air. This can be achieved through proper ventilation systems and by monitoring gas concentrations regularly.
2. Pump rooms and engine rooms: These areas can accumulate flammable or toxic gases, such as those produced by fuel or oil leaks. Proper ventilation and air circulation are necessary to maintain a safe working environment and to reduce the risk of explosion or hazardous exposure.
3. Confined spaces: Enclosed spaces on a ship, such as ballast tanks, void spaces, or storage compartments, can accumulate hazardous gases if not properly ventilated. Implementing critical dilution with air can help prevent dangerous concentrations of gases from forming.

To ensure safe conditions in these areas, it is important to monitor gas concentrations continuously, have adequate ventilation systems in place, and follow proper safety procedures, such as conducting gas-free inspections before entering enclosed spaces.

LIQUID CHEMICAL CARGOES

Categories of Annex II:
Annex II of the International Convention for the Prevention of Pollution from Ships (MARPOL) contains regulations for the control of pollution by noxious liquid substances carried in bulk. The categories of Annex II are as follows:

- Category X: Noxious liquid substances which, if discharged into the sea from tank cleaning or deballasting operations, are deemed to present a major hazard to either marine resources or human health and therefore justify the prohibition of the discharge into the marine environment.
- Category Y: Noxious liquid substances which, if discharged into the sea from tank cleaning or deballasting operations, are deemed to present a hazard to either marine resources or human health or cause harm to amenities or other legitimate uses of the sea and therefore require a special area to be designated in which their discharge is prohibited or regulated.
- Category Z: Noxious liquid substances which, if discharged into the sea from tank cleaning or deballasting operations, are deemed to be of low hazard to either marine resources or human health and therefore require a general area to be designated in which their discharge is permitted under controlled conditions.

The P&A manual should be specific to the ship type and must contain detailed procedures and arrangements for the loading, carriage, discharge and disposal of noxious liquid substances carried in bulk, taking into account the nature of the substance and the type of ship.

Pour Point:
Pour point is the lowest temperature at which a liquid fuel, such as diesel or lubricating oil, will flow under certain conditions. At temperatures below the pour point, the fuel will become thick and solidify, causing issues such as clogging of fuel lines, filters, and pumps, and potentially leading to engine failure. Pour point is a critical property for liquid fuels that are used in colder climates or in applications where the fuel may be subject to low temperatures, such as during storage or transportation. Lower pour points are generally preferred for these types of applications to ensure that the fuel remains liquid and flowable even under very cold conditions.

IMDG

Class 4.2:
Class 4.2 refers to "Substances liable to spontaneous combustion". These are substances which are likely to ignite and burn without an external ignition source. Examples include oily rags, coal, and certain types of chemicals. Proper handling and

stowage of Class 4.2 substances is important to prevent spontaneous combustion and fire onboard.

Class 7:
Class 7 refers to "Radioactive materials". These are materials that emit ionizing radiation, such as uranium and plutonium. Radioactive materials are hazardous due to the potential damage they can cause to living organisms. Proper handling and stowage of Class 7 substances is important to prevent exposure to radiation and ensure safety onboard. Regulations and procedures for the safe transport of radioactive materials are very strict and require specialized training and equipment.

IMDG loading precautions?
1. Segregation: Dangerous goods should be segregated from other incompatible substances to prevent adverse reactions or incidents. The IMDG Code provides a segregation table that outlines the required separation distances between different classes of dangerous goods.
2. Stowage: IMDG cargoes should be properly stowed in designated areas according to their class and nature. Some goods may require special stowage conditions, such as temperature control or ventilation. The IMDG Code provides guidance on appropriate stowage locations and requirements.
3. Packaging: Dangerous goods must be packed in containers that meet specific standards and are suitable for their nature and hazard potential. The packaging should be marked and labeled with the appropriate hazard symbols, class, and UN number.
4. Documentation: Accurate and complete documentation is essential for the safe handling and transportation of IMDG cargoes. The shipper must provide a Dangerous Goods Declaration, which includes information about the nature, quantity, and properties of the dangerous goods, as well as emergency contact information.
5. Training: Crew members handling IMDG cargoes should be properly trained in the handling, storage, and emergency procedures for dangerous goods. This training should be updated regularly to ensure that crew members remain competent and aware of any changes in regulations or best practices.

Which books to refer while loading IMDG cargoes?
1. International Maritime Dangerous Goods (IMDG) Code
2. Emergency Response Guidebook (ERG)
3. UN Number
4. Proper Shipping Name (PSN)
5. Emergency Schedules (EmS)
6. Medical First Aid Guide (MFAG)
7. Shipper's guides or company-specific guidelines

Hazards of Coal:
Coal has several potential hazards associated with its storage, handling, and transport, some of which include:

- Fire and explosion hazard: Coal dust is highly flammable and can ignite in the presence of a spark or heat source, leading to fires or explosions. Coal storage facilities and cargo holds of ships carrying coal are prone to fire and explosion risks.
- Health hazards: Prolonged exposure to coal dust and other airborne particles can lead to respiratory illnesses, such as chronic bronchitis, pneumoconiosis, and lung cancer. Coal dust can also cause skin and eye irritation.
- Environmental hazards: Coal dust can cause air pollution, leading to respiratory problems and other health issues. Runoff from coal piles can contaminate nearby water sources, leading to environmental damage.
- Structural hazards: Due to its weight and bulk, coal can cause structural damage to ships and other transport vessels if not properly loaded and secured.
- Spontaneous combustion hazard: In some cases, coal can spontaneously combust due to internal heat buildup, especially when stored in large quantities in confined spaces. This can pose a significant fire risk.

It is therefore important to handle, store, and transport coal with the utmost care to minimize the risks of these hazards. Proper ventilation, dust suppression, and fire prevention measures are crucial in ensuring safe operations with coal.

Hazards of Sulphur:

Sulphur is a hazardous material that can pose several risks to human health and the environment. Some of the hazards of sulphur include:

- Skin and eye irritation: Sulphur can cause irritation and burning of the skin and eyes on contact.
- Inhalation hazards: Sulphur can release toxic gases such as sulphur dioxide when heated, causing respiratory problems if inhaled.
- Fire and explosion risks: Sulphur is combustible and can catch fire easily when exposed to heat or flames. It can also produce flammable gases when exposed to water, leading to the risk of explosion.
- Corrosive properties: Sulphuric acid is a highly corrosive substance that can cause damage to metals, concrete, and other materials. Sulphuric acid can also cause burns and other injuries on contact with the skin and eyes.
- Environmental hazards: Sulphur emissions from industrial processes can lead to acid rain, which can cause damage to crops, forests, and aquatic life. Sulphur can also contaminate soil and groundwater, leading to long-term environmental damage.

It is essential to handle and transport sulphur with caution and following all safety procedures and guidelines to minimize the risks and hazards associated with it.

Which is more dangerous and why?

It is difficult to determine which hazardous material is more dangerous as each material has its own unique hazards and risks depending on factors such as toxicity, flammability, explosiveness, and potential for environmental harm. The level of danger also depends on the amount and concentration of the material being handled, as well as the specific circumstances of the situation, such as the location, method of handling, and potential sources of ignition or other hazards. It is important to understand the hazards and risks associated with any hazardous material, and to

take appropriate measures to ensure safe handling and transport.

BULK CARGOES

Types of securing of Grain:
There are several methods for securing grain on board a ship, including:

- Bagged grain: This method involves stacking bags of grain on top of each other and using lashings to secure the bags in place. The lashings should be tight enough to prevent the bags from shifting or sliding.
- Bulkheads: Bulkheads are used to divide the cargo hold into compartments. Each compartment is filled with grain, and the bulkheads are secured in place to prevent the grain from shifting.
- Timber dunnage: Timber dunnage is used to create a level surface on the cargo hold floor. The grain is then poured on top of the dunnage and leveled off. The timber should be tightly secured in place to prevent it from shifting.
- Air bags: Air bags can be used to fill the spaces between the cargo and the walls of the cargo hold. This method is effective in preventing the grain from shifting during transit.
- Steel bars and turnbuckles: Steel bars and turnbuckles can be used to secure the grain in place. The bars are placed on top of the grain, and the turnbuckles are tightened to prevent the bars from moving.

It is important to ensure that the securing of grain complies with the requirements of the International Maritime Organization (IMO) and other applicable regulations to prevent cargo shifting and damage to the ship and crew.

Explain TML:
TML (Transportable Moisture Limit) refers to the maximum moisture content in a bulk solid cargo that can be safely transported by sea without the risk of liquefaction. Liquefaction occurs when a granular material, like certain ores or mineral concentrates, absorbs water and turns into a fluid-like state under external forces such as vibration or movement. When this happens, the cargo can shift inside the hold, causing the ship to lose stability and potentially capsize. The TML is determined through laboratory testing and is expressed as a percentage of the cargo's total mass.

PV Valve, breaker settings:
PV valve (Pressure-Vacuum valve) is a safety valve used on cargo tanks to prevent over-pressure or vacuum conditions. The breaker settings of a PV valve refer to the pressure settings at which the valve opens and releases the excess pressure or vacuum.

The breaker settings are typically specified by the manufacturer and are set based on the design pressure of the tank and the pressure rating of the valve. The settings should be checked and adjusted periodically to ensure proper operation and prevent overpressure or vacuum conditions.

During cargo operations, the PV valve settings should be monitored regularly to ensure that they are set correctly for the cargo being loaded or discharged. The PV

valve should be checked before and after loading or discharging to ensure that it is operating correctly and has not been damaged or tampered with.

Explain IBC Code:
The International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code) is a set of guidelines developed by the International Maritime Organization (IMO) to provide an international standard for the safe transport of dangerous chemicals by sea. The IBC Code outlines the minimum requirements for the design, construction, and equipment of ships carrying dangerous chemicals in bulk, as well as the operational procedures that must be followed to ensure safety and prevent pollution.

The IBC Code was first adopted by the IMO in 1977 by resolution MEPC.19(22) and entered into force on July 1, 1983. Since then, it has undergone several revisions and updates to keep pace with changes in the industry and the introduction of new technologies and materials.

TIMBER

How to Lash Timber?
Lashing timber properly is essential to ensure that it is securely fastened and prevented from shifting during transportation. Here are some steps to follow for lashing timber:

- Start by ensuring that the timber is stacked securely and uniformly on the bed of the container.
- Use dunnage or chocks to fill the gaps between the timber pieces, so that they are packed tightly together.
- Place lashings around the timber stack to secure it to the container. Use a minimum of two lashings per tier of timber.
- Use wire rope, webbing straps or chains to create the lashings, depending on the weight and size of the timber.
- Pass the lashings over the timber and under the bed of the container to secure them.
- Tighten the lashings to ensure that the timber stack is held securely in place.
- Ensure that the lashings are evenly spaced and tight enough to prevent any movement of the timber during transportation.
- Use edge protectors on the corners of the timber to prevent any damage caused by the lashings.
- Finally, check the lashings and timber stack regularly during transportation to ensure that they remain secure.

It is important to follow proper lashing and securing techniques when transporting timber, to prevent accidents and damage to the cargo, as well as to ensure compliance with relevant regulations and standards.

IMSBC

Group of cargoes under IMSBC (A,B,C):
Under the International Maritime Solid Bulk Cargoes (IMSBC) Code, the solid bulk cargoes are divided into three groups as follows:
Group A: Cargoes which may liquefy if shipped at a moisture content in excess of their transportable moisture limit (TML). These cargoes are known as "solid bulk cargoes prone to liquefaction" and require special precautions to be taken during transportation.
Group B: Cargoes which possess a chemical hazard that could give rise to a dangerous situation on board the ship.
Group C: Cargoes which are not prone to liquefaction and do not possess chemical hazards, but may have other dangers such as flammability or toxicity.

IMSBC part 2 Cargo, explain:
Part 2 of the International Maritime Solid Bulk Cargoes (IMSBC) Code provides detailed information on the individual cargoes and their properties. It includes the chemical and physical properties of each cargo, such as its particle size, angle of repose, bulk density, moisture content, and toxicological hazards. Part 2 also provides information on the appropriate stowage and segregation of the cargoes on board, as well as the necessary precautions for handling, loading, and unloading the cargo. The information in Part 2 is critical for ensuring the safe transportation of solid bulk cargoes by sea.

FMP:
FMP (Flow Moisture Point) is a term used to describe the temperature at which a bulk solid material begins to flow under its own weight after a certain amount of moisture has been added. The FMP is determined by measuring the moisture content and flow properties of a sample of the material at different temperatures.

The FMP is important in many industrial processes involving the handling and storage of bulk solids such as grains, powdered chemicals, and fertilizers. The FMP is used to determine the safe storage and handling conditions for these materials, and to prevent caking, clumping, or other problems that can occur when the material becomes too moist.

FMP testing involves the use of a flowability tester, which measures the flow properties of the material at different temperatures and moisture levels. The tester applies a controlled amount of pressure to the sample and measures the force required to cause the material to flow.

The FMP is typically expressed as a temperature range, with a lower and upper limit. The lower limit is the temperature at which the material just begins to flow, while the upper limit is the temperature at which the material becomes too fluid and loses its ability to maintain its shape.

Overall, the FMP is an important parameter for understanding the flow behavior and handling properties of bulk solids, and is used in a wide range of industrial applications to ensure safe and efficient handling of materials.

TML:
The Transportable Moisture Limit (TML) is a critical parameter for the safe transport of bulk cargo, particularly mineral ore fines, which are prone to liquefaction. The TML is the maximum moisture content of a cargo that can be considered safe for transportation under normal conditions.

Here are some key points about the TML:
- The TML is defined in the International Maritime Solid Bulk Cargoes (IMSBC) Code, which is a mandatory instrument under the International Convention for the Safety of Life at Sea (SOLAS).
- The TML is determined through a laboratory test procedure, which involves measuring the flow moisture point (FMP) of the cargo. The FMP is the moisture content at which the cargo begins to exhibit flow properties.
- The TML is calculated as 90% of the FMP, in order to provide a safety margin.
- If the moisture content of a cargo exceeds the TML, it may become unstable and prone to liquefaction. This can lead to a loss of stability and a risk of capsizing for the vessel carrying the cargo.
- Before loading a cargo, the shipper must provide a certificate stating the moisture content and the TML of the cargo. The shipper is responsible for ensuring that the cargo is safe for transport.
- The vessel's master or responsible officer must verify the cargo's moisture content and TML before loading, and must take appropriate measures to prevent the cargo from exceeding the TML during transport.
- If a vessel is carrying a cargo that exceeds the TML, it may be detained and not allowed to proceed until the cargo is made safe or offloaded.

Moisture Migration:
Moisture migration refers to the movement of moisture within a cargo during transport. It can occur in a variety of cargoes, including agricultural products, metals, and chemicals, and can be caused by changes in temperature, humidity, or other environmental factors.

Here are some key points about moisture migration:
- Moisture migration can cause damage to cargo, including spoilage, corrosion, and contamination.
- Cargo owners and carriers have a responsibility to ensure that cargoes are properly protected from moisture migration during transport.
- There are several methods for controlling moisture migration, including proper ventilation, the use of desiccants or dehumidifiers, and the application of coatings or films to cargo surfaces.
- Moisture migration can be monitored using various technologies, including moisture sensors and moisture indicators.
- The transportable moisture limit (TML) is an important parameter for determining the safe moisture content of bulk cargoes that are susceptible to liquefaction during transport.
- Proper cargo stowage and securing is essential for minimizing the risk of moisture migration, as well as other types of cargo damage.

Formula for Moisture Migration:
Moisture migration is a complex phenomenon and there is no specific formula to describe it. It depends on various factors such as the moisture content of the cargo, temperature, humidity, ventilation, stowage conditions, and the physical properties of the cargo.

However, there are some empirical formulas and calculation methods that can estimate the moisture migration in certain types of cargoes. For example, in the case of grain cargoes, the moisture migration rate can be calculated using the following formula:

$$Q = 0.01 * A * H * (T1 - T2)$$

Where,

Q is the quantity of moisture migrating in a day (in metric tons),
A is the area of the cargo surface (in square meters),
H is the height of the cargo (in meters),
T1 is the temperature inside the cargo hold (in Celsius),
T2 is the dew point temperature (in Celsius).

This formula gives an approximate value of the moisture migration, and it should be used in conjunction with other methods such as cargo monitoring, ventilation control, and temperature management to prevent moisture damage to the cargo.

Angle of Repose:
Angle of repose is the maximum angle of inclination that a granular material, such as soil or grains, can be piled up without collapsing. It is the steepest angle at which a material can be maintained on a slope without sliding downhill. The angle of repose varies depending on the size, shape, and cohesiveness of the grains, as well as other factors such as moisture content and packing density. It is an important factor in the safe and efficient transport and storage of bulk materials such as grains, ores, and powders. In shipping, the angle of repose is taken into account when determining the stowage and securing requirements for cargoes.

Low angle of repose dangerous or higher and why?
A low angle of repose can be dangerous for bulk cargoes because it can lead to shifting and instability during transport. When the angle of repose is low, the cargo particles tend to slide and shift more easily, making it more difficult to maintain a stable load. This can increase the risk of capsizing or cargo shifting during transport, which can lead to damage to the vessel or even loss of the cargo. Higher angles of repose can help to improve the stability of the cargo, but it is still important to properly secure and stow the cargo to ensure safe transport.

What are High Density Cargoes?
High-density cargo refers to cargoes that have a high weight-to-volume ratio, meaning they are heavy but take up relatively little space. Some examples of high-density cargoes include metal ores, concentrates, and scrap, as well as certain chemicals and minerals. Because of their high density, these cargoes can present stability and structural concerns on board a vessel and require careful handling and stowage arrangements. They may also require specific precautions to be taken in the

event of a cargo shift or other emergency situation.

CONTAINERS

Lashing of Containers:
Lashing of containers is the process of securing containers on board a vessel to ensure that they are safely transported without shifting, sliding, or falling during the voyage. The lashing is carried out using a combination of twist locks, lashings, and turnbuckles.

The following are the general steps involved in the lashing of containers:
- Positioning of containers: The containers are positioned on the vessel's deck in such a way that they are secured in place and do not move during the voyage.
- Fitting of twist locks: Twist locks are used to attach the corners of the container to the ship's fittings. They are attached to the corner castings on the container and the fittings on the vessel's deck.
- Lashing: Once the twist locks are in place, lashings are used to secure the container. Lashings are steel wire ropes, chains or synthetic ropes used to secure the containers to the vessel.
- Turnbuckles: Turnbuckles are tightened to increase the tension in the lashings and prevent the container from moving. They are tightened using a torque wrench to a specified tightness.
- Inspection: The lashing work is inspected by the crew to ensure that the containers are secure and will not move during the voyage.

The lashing process is critical in ensuring the safety of both the vessel and the cargo it carries. Proper lashing prevents damage to the containers and the vessel, as well as ensuring the safety of the crew on board.

Lashing Equipment:
Lashing equipment is used to secure cargo on a ship and prevent it from shifting or falling during transport. There are various types of lashing equipment, including:
- Wire ropes: Wire ropes are the most common type of lashing equipment used on ships. They are made of steel wire and can be used to secure heavy loads. Wire ropes are strong and durable, and can withstand extreme weather conditions.
- Chains: Chains are also commonly used for lashing cargo on ships. They are made of steel and are very strong. Chains are suitable for securing heavy cargo.
- Webbing straps: Webbing straps are made of synthetic materials such as polyester or nylon. They are lightweight and easy to handle, and can be used to secure lighter cargo.
- Twistlocks: Twistlocks are used to lock containers together. They are made of steel and can be easily attached to the corners of shipping containers.
- D-rings: D-rings are metal rings shaped like the letter "D". They are used in conjunction with webbing straps to secure cargo.

Lashing equipment must be properly installed and tightened to ensure that cargo is secure. The use of lashing equipment is governed by international standards, such as the International Convention for Safe Containers (CSC), which sets out guidelines for the inspection and maintenance of lashing equipment.

Half Height Container Uses:

- Half-height containers are used to transport heavy and dense materials such as ores, steel, and machinery.
- They are shorter in height compared to standard containers, which allows for more weight to be loaded without exceeding the weight limits.
- Half-height containers are also useful for cargo that needs to be loaded or unloaded from the top, such as rocks or scrap metal.
- They are designed to be stacked like standard containers and can be transported on various types of cargo ships or on specialized container ships.
- Half-height containers are built to withstand the rigors of transportation, including the potential for high impact, water exposure, and other challenges.

Numbering of Containers in Hold and on Deck:

The numbering of containers in hold and on deck is essential for cargo handling operations on board a ship. The numbering system is used to identify and track the location of individual containers during loading, unloading, and stowage.

The basic principles of numbering containers are:

- Each container is assigned a unique identification number, known as the Container Number.
- The Container Number is marked on the container in large characters on both sides, in a visible and permanent manner.
- The Container Number is composed of four letters (the owner code), followed by six digits (the serial number), and a check digit.
- The owner code identifies the shipping line or container leasing company that owns the container.
- The serial number is a unique identification number assigned by the owner of the container.
- The check digit is calculated using a specific algorithm, to ensure the accuracy of the Container Number and prevent errors in data entry and tracking.
- The container number is used to track the location of the container, as well as its contents, weight, and other relevant information.

In addition to the Container Number, containers may also be marked with other identification numbers, such as the Booking Number (used to identify the specific cargo booking), the Seal Number (used to identify the container seal), and the Tare Weight (the weight of the empty container). Proper numbering and identification of containers is critical for efficient cargo handling and logistics, as well as for safety and security on board the ship.

CSC:

CSC stands for "International Convention for Safe Containers". It is a treaty that was first adopted by the International Maritime Organization (IMO) in 1972 to standardize the safety regulations for shipping containers across different countries. The CSC lays down certain minimum standards for the construction, testing, certification, maintenance and inspection of containers to ensure their safe transport by sea, land and air.

The CSC sets out the following key requirements:

- Container design and construction standards: Containers must be designed and constructed to withstand the stresses of normal transportation, handling and storage, including loading and unloading, stacking and transportation by different modes of transport.
- Certification and marking: All containers must be certified by an authorized classification society and marked with a unique identification number and other essential information such as maximum gross weight, tare weight, payload and stacking test load.
- Inspection and maintenance: Containers must be inspected and maintained in accordance with the requirements of the convention, and any necessary repairs or replacements must be made promptly to ensure their safe operation.
- Approval and control of manufacturers: Manufacturers of containers must be approved by the competent authority of the country in which they are located and must be subject to regular inspection and control to ensure that they comply with the standards of the convention.
- Training of personnel: Personnel involved in the handling, packing, stuffing and transportation of containers must be properly trained and certified in the relevant procedures and safety standards.

Compliance with the provisions of the CSC is mandatory for all containers intended for international transport. The convention has contributed significantly to the safe and efficient transport of goods by standardizing the safety requirements for shipping containers worldwide.

Info from CSC plate:

The CSC plate on a container provides important information about the container's weight, dimensions, maximum payload, and maximum gross weight, as well as the date of manufacture and other identifying details. Specifically, the following information can be found on a CSC plate:

- Container owner and identification number.
- Country of manufacture.
- Approval plate number.
- Maximum gross weight.
- Tare weight (container weight).
- Payload (maximum cargo weight).
- Maximum weight for floor and contents.
- Stacking test load.
- Forklift pocket dimensions.
- Manufacturing date.
- Testing and certification marks.
- Type of container (e.g., dry cargo, refrigerated, etc.)

This information is necessary for the safe handling, transportation, and stacking of the container, as well as for compliance with international regulations regarding the safe transportation of goods.

Dimensions of CSC plate:

The plate must be rectangular in shape and measure at least 10 cm x 20 cm.

Can you load a container with CSC plate:
No, it is not permissible to load a container without a valid CSC plate. The CSC plate certifies that the container meets the safety standards and has been inspected and tested to ensure it is structurally sound and safe for transportation. Loading a container without a CSC plate would violate international regulations and could result in fines, penalties, and delays at ports of call. Additionally, it would be unsafe to load and transport a container without the necessary inspections and certifications.

Advantages of Containers:
The advantages of containers include:

- Standardization: Containers are manufactured to a standard size and shape, which makes them easy to stack, transport, and store. This standardization also makes it easy to move containers from one mode of transportation to another, such as from ship to truck or train.
- Efficiency: Containers can be loaded and unloaded quickly using cranes and other specialized equipment, which reduces the time and cost involved in moving cargo. This also makes it possible to move large volumes of cargo in a short period of time.
- Security: Containers can be sealed to prevent unauthorized access and to protect the contents from theft, damage, or tampering. This makes them ideal for transporting high-value or sensitive cargo.
- Versatility: Containers can be used to transport a wide range of cargo, from small, lightweight items to heavy machinery and vehicles. They can also be modified or customized to suit specific cargo requirements, such as refrigeration or ventilation.
- Cost-effectiveness: Containers can be reused many times, which makes them a cost-effective option for transporting cargo. They also reduce the need for packaging and handling, which can save money on labor and materials.
- Environmental benefits: The use of containers in shipping can reduce the amount of packaging and waste generated by traditional shipping methods. Additionally, containers can be designed for maximum space utilization, which can reduce the number of trips required to transport cargo, resulting in lower fuel consumption and emissions.

HEAVY LIFT

Heavy Lift Precautions:
1. Planning: Thorough planning of the lifting operation is crucial. Assess the weight and dimensions of the load, the capacity and reach of the lifting equipment, and any environmental factors (e.g., weather, sea conditions) that may affect the operation. Create a detailed lifting plan that outlines the step-by-step process, equipment configuration, and personnel responsibilities.
2. Inspection: Inspect the lifting equipment, including derricks, cranes, wires, ropes, slings, shackles, and hooks, to ensure they are in good condition and suitable for the task. Check for any signs of wear, corrosion, or damage that may compromise the

equipment's integrity.
3. Load capacity: Make sure the lifting equipment's capacity is sufficient for the weight of the load. Do not exceed the equipment's rated capacity, as this can lead to equipment failure and accidents.
4. Rigging: Properly rig the load, ensuring that slings, shackles, and other rigging gear are correctly sized and positioned to distribute the weight evenly. Use appropriate lifting points and consider the load's center of gravity to maintain stability during the lift.
5. Communication: Establish clear communication channels and protocols among the crew members involved in the operation. Use hand signals, radios, or other methods to ensure everyone understands their responsibilities and can communicate any concerns or issues that arise during the lift.
6. Securing the area: Clear the lifting area of any obstructions and ensure that only essential personnel are present during the operation. Keep non-essential crew members and bystanders at a safe distance.
7. Weather and sea conditions: Monitor the weather and sea conditions during the operation. High winds, rough seas, or poor visibility can increase the risk of accidents. If necessary, postpone the lift until conditions improve.
8. Supervision: Assign a competent person to oversee the lifting operation, ensuring that all safety precautions are followed, and the lift is carried out according to the plan.
9. Emergency procedures: Have an emergency response plan in place, including procedures for dealing with equipment failure, injuries, or other unexpected events during the lift.
10. Training: Ensure that all crew members involved in the heavy lift operation are adequately trained and familiar with the equipment, safety procedures, and their specific responsibilities.

GENERAL CARGO

Chain Register:
A chain register is a record of the lengths of the anchor chain or cable that are used on a vessel. The register provides important information about the condition and history of the chain or cable, including when it was purchased, when it was last inspected and tested, and any repairs or replacements that have been made. It also includes the date of each inspection, the measured length of the chain or cable, and any notes about its condition. The chain register is an important tool for ensuring that the anchor chain or cable is in good condition and that it meets the requirements for safe and efficient anchoring operations.

Contents of Chain Register:
A chain register is a document used to keep track of the condition, usage, and maintenance of a ship's anchor chain. The contents of a chain register may vary depending on the specific requirements of the ship and the company, but typically include:
- Details of the ship: The name of the ship, call sign, port of registry, and other identifying information.
- Details of the chain: The size, type, and length of the anchor chain.

- Chain markings: The chain markings or identification numbers to aid in keeping track of the length of chain used during anchoring operations.
- Chain condition: A record of the chain's condition, including any visible defects, such as kinks, twists, or broken links.
- Chain usage: The length of chain used during anchoring operations, the location of the operation, and the duration of use.
- Chain maintenance: A record of maintenance activities performed on the chain, such as cleaning, lubrication, and inspections.
- Chain certification: Details of the chain's certification, including the date of certification, the certifying authority, and the expiration date of the certificate.
- Other relevant information: Other information that may be useful for the safe operation of the ship, such as the date of the last overhaul of the anchor windlass or the date of the last calibration of the chain measuring equipment.

P & A Manual:
A Procedures and Arrangements (P&A) Manual is a document that outlines the procedures and safety arrangements that are in place on a ship. It contains important information about the ship's systems and equipment, including safety equipment, communication systems, navigation systems, firefighting equipment, and life-saving appliances. The manual is typically created by the ship's management and crew and is designed to provide guidance to the crew in case of emergency situations. The P&A manual is an essential document on board a ship, and all crew members should be familiar with its contents.

Procedures & Arrangements (P&A) Manual, applicable to which ships?
The Procedures and Arrangements (P&A) Manual is a required document for all types of ships, including passenger ships, cargo ships, tankers, and offshore support vessels. It is used to provide guidance and instructions to the crew on a wide range of operational and emergency procedures and equipment arrangements. The P&A Manual is an essential tool for ensuring that the crew is prepared to respond quickly and effectively in the event of an emergency, and that they are aware of the proper procedures to follow for routine operations.

Under which convention and Annex?
The Procedures and Arrangements (P&A) Manual is a requirement under the International Maritime Organization's (IMO) International Convention for the Safety of Life at Sea (SOLAS) Convention, specifically in Chapter II-2, Regulation 15. The P&A manual is also referred to in SOLAS Chapter VI, Regulation 2, and in the International Code for Fire Safety Systems (FSS Code), which is an annex to SOLAS Chapter II-2.

DAMAGE TO CARGO SPACES

LEL: LEL stands for Lower Explosive Limit. It is a term used in the field of occupational safety and health to describe the lowest concentration of a combustible

gas or vapor in the air that can create an explosion or fire when it comes in contact with a source of ignition.

LEL is typically expressed as a percentage of the gas or vapor in the air by volume. For example, the LEL of methane is 5%, which means that an atmosphere containing 5% or more methane gas in the air can be considered to be potentially explosive.

LEL is an important safety consideration in industries where flammable gases or vapors are present, such as oil and gas production, chemical manufacturing, and mining. Workers must be trained to monitor LEL levels and take appropriate precautions to prevent explosions or fires, such as proper ventilation, the use of explosion-proof equipment, and the use of personal protective equipment.

MISCELLANEOUS

How will you take over watch on Tanker while discharge?

Assuming that you are taking over as the Officer of the Watch (OOW) on a tanker vessel that is currently discharging cargo, here are some general steps that you may follow:

1. Familiarize yourself with the cargo and discharge plan, including the location and status of the cargo tanks, discharge pumps, pipelines, and valves.
2. Verify that the discharge system is operating within the specified parameters, such as the discharge rate, temperature, and pressure.
3. Conduct a visual inspection of the cargo deck, manifold, and surrounding areas for any signs of leakage, spillage, or fire hazards.
4. Review the ship's stability and trim calculations, and ensure that the vessel is complying with the draft, freeboard, and other requirements.
5. Monitor the engine room and other critical systems, and coordinate with the Chief Engineer and other relevant personnel as needed.
6. Maintain a continuous watch on the vessel's radar, AIS, and other navigation equipment, and be aware of the vessel's position, course, speed, and proximity to other vessels, navigational hazards, and restricted areas.
7. Communicate with the vessel's crew, including the cargo watch and deck personnel, and ensure that all necessary reports, logs, and records are properly maintained.

VGM:

VGM stands for Verified Gross Mass and is a mandatory requirement under the International Convention for the Safety of Life at Sea (SOLAS) for all packed containers being shipped by sea. It is the weight of the container and its contents as determined by weighing the packed container using calibrated and certified equipment. The VGM must be provided to the shipping line and terminal operator prior to loading on board the ship to ensure the safe stowage and handling of containers during transportation. The VGM is important to prevent accidents caused by incorrect weight declarations, which can lead to container stack collapses, cargo shifting, and vessel stability issues.

********** ********** BEST OF LUCK **********