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GENERAL:

The vessel’s Ship operational manual gives information regarding the safe handling storage and discharge of Chemicals in bulk and is in compliance with the guidelines of the BCH Code as well as United State of America ,Federal register 33 CFR 155.750 (a)……(d)

While not all information is complied under one cover the following manuals are to be used in conjunction with this manual.

**Procedures & Arrangement Manual 33 CFR 155.750 (a),1,(iii),2,(I)
**Vessel Oil pollution Response Plan- OPA 90 33 CFR 155.750 (a),(9)
**Vessel Response Plan for use in International Waters SOPEP 33 CFR 155.750 (a),(9)
**Vessel Stability Calculations Booklet 33 CFR 155.750 (a),(1),(iii)
SHIP OPERATIONAL MANUAL

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CHAPTER 1

SHIP OPERATION RESPONSIBILITIES

1.2 Organization /duty of ship’s operation

1.2.1 Organization / duty of officer /crew

Deck department

Captain : The highest person in charge for operation
Chief officer : Person in charge for operation business
2nd officer : Assist. To person in charge for operation business
3rd officer : “
Bosun : Works for operation of the ship
Pumpman : “
Sailor : “
Sailor : “
Sailor : “

Engine department

Chief engineer : Person in charge for engine
1st engineer : Person in charge for engine
2nd engineer : Assist to person in charge for engine
3rd engineer : “
Electric Officer : Person in charge for electric business
Donkey man : Works for engine
Fitter : Works for engine and deck
No. 1 oiler : Works for engine
Oiler (3) : “

Radio department

Radio operator : person in charge for radio operation business

Steward department

Steward : Person in charge for steward
Cook : Works for cook

1.2.2. Operation list of person in charge

The highest person in charge for cargo operation : Captain
Supervisor of cargo operation : Chief officer
Person in charge for maintenance / operation of cargo pumps , machinery of hydraulic system : Chief engineer
Person in charge for control of cargo operation protecting equipments and cargo machinery : 1st officer.
a. Loading

(1) Decision of cargo tanks and cargo lines to be loaded;
Captain and Chief officer Check of stowage plans
and trim/stability/stress calculation : C. Officer

(2) Operation of cargo loading

a. Supervisor : Chief officer Assistant; OOW
b. Cargo hose connecting : OOW
c. Level gauge / alarming system (functional test ) : OOW, Pumpman
d. Bonding / Earth cables fitting : OOW
e. Machinery plugs fitting onto deck scuppers : OOW/Bosun
f. Cargo valves operation : OOW/Pumpman
g. Check of completion of preparation for cargo loading : Chief off. / Pumpman
h. Check of completion of preparation for cargo loading : Chief officer
i. Information to shore side of completion for cargo loading : Chief officer
j. Commencement of cargo loading by shore side pump : Chief officer
k. Check of cargo systems during loading : OOW
l. Check of activity of ventilate : Bosun and sailor
m. Check of loading rate : OOW
n. Information to shore side before completion of loading : Chief officer
o. Information to shore side loading cargo reached a liquid level which is planned and stop cargo loading : Chief officer
p. Cargo valves operation : OOW/pumpman
q. Check of cargo loading capacity with a responsible person of shore side : Chief officer
r. Disconnecting earth cable : OOW
s. Disconnecting cargo hose : OOW, Pumpman, sailor
t. Taking off wood plugs : Sailor/Bosun
u. Check of completion of cargo loading : Chief officer/pumpman

b. Unloading

(1) Decision of unloading plan
a. Decision of cargo pump / lines to be used : Captain/Chief officer
b. Unloading plan agreed by shore side and the ship : Chief officer

(2) Unloading work

a. Connecting cargo hoses : OOW, bosun, pumpman, sailor
b. Connecting earth cable : OOW
c. Placing drip tray : Pumpman, & sailor
d. Fitting wood plugs onto deck scuppers : Bosun and sailor
e. Starting generators with auxiliary machinery : 1st engineer
f. Information to chief officer of completion of engine : 2nd engineer
g. Cargo valves operation : OOW, p.man
h. Starting hydraulic power : OOW
i. Information to shore side of completion of unloading preparation : Chief officer
j. Handling hydraulic operation handle for cargo pump : OOW
k. Check of cargo system during unloading : OOW and p.man
l. Check of pressure gauge of cargo pump : Chief officer and 1st engine
m. Check of unloading rate : OOW
n. Information to shore side “before completion of unloading” : Chief officer
o. Stopping cargo pumps with hydraulic operation handle : Chief officer
p. Check of completion of unloading by pressure gauge of cargo pumps and change of transferring sound : Chief officer & OOW

At final stage of unloading, control of cargo suction side valves and low load operation of cargo pumps are carried out by 2nd officer and p.man under supervision of chief officer.

q. Cargo valves operation : OOW, pumpman and sailor
r. Information to shore side “Completion of unloading” : Chief officer
s. Stopping hydraulic power and information to engine side “Completion of unloading” : OOW
t. Stopping one (1) generator with auxiliary machinery : 2nd engineer
u. Disconnecting cargo hoses : OOW, bosun, pumpman.
v. Disconnecting earth cable : OOW
w. taking off wood plug : Bosun

**c. Personnel protection during cargo handling**

(A) Prior to commencement of the cargo handling under the supervision of the chief officer:
- Gas detectors, first aid kit, safety equipment and antidotes are to be provided nearest position of cargo area.
- Decontamination showers and eye wash are to be led with water into them.

(B) Persons involved in the cargo handling should work with protection helmet, clothes, gloves and boots, and if necessary, protection mask. These supervisor is the chief officer.
CHAPTER 2

FUNDAMENTAL CARGO INFORMATION

2.1. Fundamental Knowledge

Fundamental knowledge for physics, chemistry and hazardous properties of products is necessary for the safe carriage and handling of chemicals. Elementary physics, chemistry and hazardous properties which should be instructed for persons concerned are example in the document of “Recommendation on Training and Qualifications of Officers and Crews of Ships Carrying Hazardous or Noxious Chemicals in Bulk, Annex of IMC Resolution A286 (VIII)”, and an extraction is shown below;

Extraction from the Recommendation

General

(I) Elementary Physics:
An outline treatment including practical demonstration of the physical properties of chemicals carried in bulk; vapour pressure/temperature relationship. Influence of pressure on boiling temperature. Explanation of saturated vapour pressure, diffusion partial pressure, flammability limit, flashpoint and autoignition temperature. Practical significance of flashpoint and low flammable limit. Simple explanation of types of electrostatic charge generation.

(II) Elementary Chemistry:
Chemical symbols and structures, elements of chemistry of acids and bases, structure and properties of well-known chemicals carried, chemical reaction of well-known grouping, sufficient to enable proper utilisation of Codes.

(III) Toxicity:
Simple principles and explanation of basic concepts; toxicity limits, systemic poisons and irritants. Coefficient of cubic expansion. The fractional increase in volume for a 1*C rise in temperature. Chemical with stabiliser. This is a chemical which has inhibitor or additive. Inhibitor Substance which inhibits any chemical reaction.

PH value:
This used for denoting the hydrogen ion concentration in solution.
The actual PH range is 0 - 14.
PH 7 means perfect neutral.
PH 1 means more acid (dilute hydrochloric acid) and PH 13 means more alkali (caustic soda solution)

Polymerisation:
This is a phenomenon that a molecule in certain compound becomes a larger unit by involving two molecules or several tens of molecules. This new unit is called as polymerisation. Polymerisation may cause some compound to change from free liquid condition to the fluid with viscosity or to the solid condition. Abundant heat is produced in this case. Polymerization may occur automatically without any external influences. Also polymerisation may occur in the case that a compound is heated, or added by catalyse or impurities. Polymerisation may be dangerous in some circumstances.

Health hazard:
This is a substance which gives injurious or vital influence to person when skin contact inhalation and ingestion are made. However, the corrosive liquid such as acid liquid which gives vital influence in the above cases is not specified as a toxic cargo in this manual.

Reid vapour pressure (R.V.P.):
The vapour pressure of a liquid determined by laboratory testing in a standard manner in the Reid Apparatus at a standard temperature of 100*F (37.8*C)
This pressure is, in general, denoted by pounds per square inch, absolute pressure (R.V.P...1b)

**Self reaction**

In general, this is a property of the chemical substance which reacts only on polymerization or analysis itself. The self-reaction may be promoted by the mixture with a very small amount of foreign matters.

**Solubility**

The solubility of a substance in water, at a specified temperature, is the maximum weight of substance which will dissolve in a given weight of water, in the presence of undissolved substance. The value is usually expressed as the number of grams of substance dissolving in 100 grams of water.

In the case of liquid dissolving in liquid, the term “miscibility” is often used instead of “solubility.”

Ethanol dissolves in water at ordinary temperature in all proportions, and is said to be completely miscible.

A hydrocarbon and water, on the other hand, are immiscible.

Aniline and water are partially miscible.

**Specific Gravity**

This is a ratio of a substance weight at temperature $t_1$ to the water weight at temperature $t_2$ with the same volume as that of water. $t_1$ need not be equal to $t_2$.

As the temperature affects greatly the volume, the comparable temperatures are shown in the data sheet.

(Example)

S.G. = 0.982 \hspace{1cm} 20°C / 15°C

20°C : Substance temperature

15°C : Water temperature

**Threshold Limit Value (T.L.V.)**

T.L.V. is the maximum concentration of gases, vapours, mist or spray to which it is believed that nearly all persons may be repeatedly exposed for a long period without adverse effects. However, carolled be taken for that the susceptibility of individuals will vary even though the concentration is below T.L.V. T.L.V. does not always draw a definite line between safe and dangerous concentrations. But it must be regarded that the concentration below T.L.V. is safe for persons on board against the long time exposure and the concentration over T.L.V. is dangerous for persons on board even though they are exposed only for a short time. In other words, breathing apparatus must be worn when the gas or vapour concentration is over T.L.V. or the spaces with such concentration is entered.

2.2. **Explanation of the “term“ used in the data sheet**

i) CDG UN No. Number of the United Nations

ii) Table number categorised by the J.G. on the attached sheets.

This is a table number in the “Regulation for carrying dangerous goods and their storage“

1. Powders
2. High pressure gases
3. Corrosive substances
4. Toxic substances
5. Flammable liquid
6. Substance becoming dangerous by reacting on water or air
7. Easily oxidizable substances
8. Inflammable solid
9.1. Noxious substances
9.2. Organised peroxide
10. Dangerous goods used always

iii) Guidelines for the categorisation of noxious liquid substances.
# Category A

Substances which are bioaccumulated and liable to produce a hazard to aquatic or human health, or which are highly toxic to aquatic life (as expressed by a Hazard Rating 3, defined by a Tlm of 1 or more, but less than 10 ppm) when particular weight is given to additional factors in the hazard profile or to special characteristics of the substances.

# Category B

Substances which are bioaccumulated with a short retention of the order of one week or less; or which are liable to produce tainting of the sea food; or which are moderately toxic to aquatic life (as expressed by a Hazard Rating 3, defined by a Tlm of less than 10 ppm); and additionally certain substances which are slightly toxic to aquatic life (as expressed by a Hazard Rating 2, defined by a Tlm of 1 ppm or more, but less than 100 ppm) when particular weight is given to additional factors in hazard profile or to special characteristics of the substances.

# Category C

Substances which are slightly toxic to aquatic life (as expressed by a Hazard Rating 2, defined by a Tlm of less than 100 ppm); and additionally certain substances which are practically non-toxic to aquatic life (as expressed by a Hazard Rating 1, defined by a Tlm of 100 ppm or more, but less than 1,000 ppm) when particular weight is given to additional factors in the hazard profile or to special characteristics of the substance.

# Category D

Substances which are practically non-toxic to aquatic life, (as expressed by a Hazard Rating 1, defined by a Tlm of 100 ppm or more, but less than 1,000 ppm); or causing deposit blanketing the seafloor with a high biochemical oxygen demand (BOD); or highly hazardous to human health, with an LD50 of less than 5 mg/kg; or persistency, smell or poisonous or irritant characteristics, possibly interfering with use of beaches; or moderately hazardous to human health, with an LD50 of 50 mg/kg or more, but less than 50 mg/kg and produce slight reduction of amenities.

# Category N (Annex II)

Substances other than those in the above categories but specified in the Annex II and III.

## IMDG CODE CLASS

Classes in the International Maritime Dangerous Goods Code are as follows:

<table>
<thead>
<tr>
<th>Class</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Explosive substances</td>
</tr>
<tr>
<td>2</td>
<td>Compressed, liquefied or dissolved gas</td>
</tr>
<tr>
<td>3</td>
<td>Flammable liquid</td>
</tr>
<tr>
<td>4</td>
<td>Flammable solid, substance liable to ignite naturally or substance producing flammable gas when wetted.</td>
</tr>
<tr>
<td>4.1</td>
<td>Flammable solid</td>
</tr>
<tr>
<td>4.2</td>
<td>Substance producing flammable gas when wetted.</td>
</tr>
<tr>
<td>5</td>
<td>Oxide and organized oxide</td>
</tr>
<tr>
<td>5.1</td>
<td>Oxide</td>
</tr>
<tr>
<td>5.2</td>
<td>Organized oxide</td>
</tr>
<tr>
<td>6</td>
<td>Noxious (toxic) substance</td>
</tr>
<tr>
<td>6.1</td>
<td>Noxious (toxic) substance</td>
</tr>
<tr>
<td>7</td>
<td>Radioactive substance</td>
</tr>
<tr>
<td>8</td>
<td>Corrosive substance</td>
</tr>
<tr>
<td>9</td>
<td>Mixed substance</td>
</tr>
</tbody>
</table>

## Ship Form

There are three (3) categories in ship form from the “IMO A212 (VII) CODE for the Construction and Equipment of Ship Carrying Dangerous Chemicals in Bulk.”

### Type 1
This is the most severe type for protecting hazard and is applied to the ship which is considered to spread the hazard chemicals in the wider area outside the ship. This is a type which is possible to prevent the hazard chemicals from spreading even though the ship is stranded or collides.

Type 2

This is not so severe as the type 1 and allowed to spread certain amount of the chemicals to some extent. This is also a type which requires sufficient construction to prevent the chemicals from spreading.

Type 3

This is not severe as the type 2 and is a type to increase floatability when the ship is damaged comparing with ordinary oil tankers. This type applies to the cargo which requires adequate storage.

2.3. Elementary physics

Specific gravity

This is a ratio of liquid weight to the water weight of the volume equal to that of the liquid. In other words, specifies gravity is a ratio of the density of the substance at temperature \( t_1 \) °C to the density of water at \( t_2 \) °C and is generally expressed as \( \frac{d_1}{d_2} \). Water density may be considered as 1 when water temperatures is 4°C, so the specific gravity of substance at \( t_2 = 4 \) °C is equal to its density.

Boiling point and vapour pressure

The vapour pressure means the pressure produced by vapour. The vapour pressure in the case of the vapour at an equilibrium with the liquid is the saturated vapour pressure and is generally called as vapour pressure.

As the temperature is the raised the vapour pressure increases and when it becomes equal to the external pressure of the liquid, bubbles from and the liquid is said to boil.

The temperature when the vapour pressure becomes equal to the external pressure of one (1) atmosphere (760 mmHg) is called as a standard boiling point. The boiling point when the pressure is lower than one (1) atmosphere becomes lower than the standard boiling point and when the boiling point is over one (1) atmosphere the boiling point becomes higher than the standard boiling point.

The relation between the vapour pressure and the temperature is expressed by the Clasiusclapeyron’s equation

\[
\frac{dP}{dT} = \frac{L}{T(V_v - V_L)}
\]

Where

\( P \) = Vapour pressure at temperature \( T \) (K)
\( L \) = Evaporating heat of molecule
\( V_v \) = Molecule volume in vapour

By integrating the equation (1) with the use of \( PV = RT \) and the assumption \( VL = 0 \) in the equation (1), the following equation can be obtained.

\[
\frac{\ln P_1}{P_2} = \frac{L}{R} \left( \frac{1}{T_1} - \frac{1}{T_2} \right)
\]

Where

\( P_i \) = Vapour pressure \( i=1,2 \) at temperature \( T_i \)
From the equation (2), the vapour pressure at a given temperature can be calculated approximately. A well known equation other than the equation (2) is Antoine’s equation below:

\[
\log_{10} \text{mmHg} = A - \frac{B}{(C + t \,^{\circ}\text{C})} \quad \text{.................................................... (3)}
\]

The values A, B, and C can be obtained from handbook, etc.

**Reid Vapour Pressure (R.V.P.)**

The vapour pressure of a liquid determined by laboratory testing in a standard manner in the Raid Apparatus at the standard temperature of 37.8°C (100°F).

**Freezing point (Melting point)**

The temperature at which the liquid state of a substance is in equilibrium with the solid state, i.e., at a higher temperature the solid will melt and at a lower temperature the solid will solidify. Freezing point and melting point may not always coincide, but they are sufficiently close to enable the difference between them to be ignored for the purpose of cargo handling.

**Coefficient of cubic expansion**

The fractional increase in volume for 1°C rise in temperature.

**Vapour density**

This is a ratio of the molecular weight of substance to that of air (about 29)

For the example acetic acid,

**Solubility**

The solubility of a substance in water, at a specified temperature, is the maximum weight of substance will dissolve in a given weight of water. This is called as a saturated solution. The value is usually expressed as the number of grams of substance dissolving in 100 grams of water.

**Viscosity**

This is an international friction or a power in resting a change in the molecular structure of a substance. The unit of viscosity is expressed by g/cm.sec from the C.G.S. unit and is called as poise. One (1) poise is 0.1 kg/cm.sec and 0.01 poise is called as one (1) centi - poise (C.P.). The above is an absolute viscosity and the comparing the absolute viscosity with the viscosity of water at the temperature of 20°C is a specific viscosity. The value of specific viscosity is equal to that of the centi-poise (C.P.).-----(absolute viscosity devised by density) is called as kinetic viscosity and its unit is stokes (St) (m²/sec).

**Intendancy of producing static electricity.**

The characteristics for static electricity is classified by two (2) classes as follows:

<table>
<thead>
<tr>
<th>Class</th>
<th>Conductivity below</th>
<th>Conductivity above</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class A</td>
<td>10 ohm cm</td>
<td>10 ohm cm</td>
</tr>
<tr>
<td>Class B</td>
<td>10 ohm cm</td>
<td>10 ohm cm</td>
</tr>
</tbody>
</table>

Care should be taken for that these substances are able to be charged.
Conductivity over 10 ohm cm
No hazard due to static electricity
Hazard of fire and explosion

**Flash point**

When heating a specimen at a constant conditions, the specimen produces sufficient vapour to make flammable mixture with flash by placing a flame near the specimen. The specimen temperature at that time is a flash point.

There are two (2) types for the flash point test, that is, close and open types. At the same specimen the flash point of the open type is slightly higher than that of the closed type.

**Explosion range**

The explosion range is determined by given electric spark to apportion of the mixture having oxidizable gas such as flammable gas and air or oxygen and checking if the flame is transferred to the whole mixed gas. Usually the higher fuel concentration is upper limit and the lower fuel concentration is lower limit.

**Auto ignition temperature**

The lower temperature to which a solid, liquid or gas requires to be raised to cause self-sustained combustion without initiation by a spark or flame.

This temperature depends upon the chemical composition.

Paraffin is the is the lowest and the aromatic is the highest in this temperature. Usually the more molecular weight is, the lower this temperature is.

**Fire extinguishing agent**

The fire extinguishing agents specified in the data sheets are in accordance with the IMCO code, ICS, NPFA,.

**Reactivity**

The number in the column for reactivity on other chemicals shows the group number in the compatibility table (A) of the USCG and the compatibility table (B) in Norway.

**2.4. Hazard to health**

**(1) TLV-TWA (TLV -Time weight average concentration )**

TLV concentration is expressed as TLV-TWA in general, and is the concentration believed to be safe for 8 hour’s exposure daily 5 days per week for prolonged period.

Care should, however, be taken for that the susceptibility of individuals will vary.

The values given in the data sheets of this manual are those accepted by the American Conference of Governmental Industrial Hygienists (ACGIH).

**(2) TLV-STEL (TLV -Short Time Exposure Limit).**

Maximum concentration which is considered safe under the following conditions:

(1) Duration of exposure to be 15 minutes or less
(2) Higher concentration exposure exceeding TLV-TWA to be 4 times or less a day.
(3) Interval of exposure to be 60 minutes or over.

**(3) Mark (C)**

This mark (C) means the upper limit that the TLV of the substance accompanied by acute physiological phenomenon should not be exceeded. This mark (C) is attached to such substances.

**(4) Mark (Skin)**
The substance with this marks mean that the substance has a hazard causing the total exposure to be increased when the substance is floating in air and/or contacts directly with skin.

(5) Health hazard rating by USCG

The first rating of VI (2) in the data sheets of this manual deals with the hazard presented by “irritating vapours” to the skin or the mucous membranes of the eyes, nose, throat and lungs. This ratings have the following meanings:

“0” Chemicals that are non volatile, or the vapours fro which are non irritating to the eyes and throat.

“1” Chemicals that cause a slight smarting of the eyes or respiratory system if present in high concentration. This effect is temporary.

“2” Chemicals vapour that cause moderate irritation, such that personnel will find high concentrations unpleasant. The effect is temporary.

“3” Moderately irritating volatile chemicals, such that personnel will not usually tolerate moderate or high vapour concentrations.

“4” Severe eye or throat irritants, vapours from which are capable of causing eye or lung injury, and which cannot be tolerated even at low concentrations.

The second rating deals with the hazard of “Irritation from liquids or solids” with regard to a chemical’s tendency to burn or irritate human skin from contact.

“0” No appreciable hazard. These chemicals are practically harmless to the skin. Included are certain volatile compounds that evaporate quickly from the skin.

“1” Minimum hazard. Usually includes chemicals that, if spilled on clothing and allowed to remain, will cause smarting and reddening of the skin.

“2” Chemicals cause smarting of the skin and first-degree burns on short exposure, and second-degree burn on long exposure.

“3” Fairly severe skin irritants, usually causing pain and second-degree burns on short contact and very injurious to the eyes.

The third rating deals with the hazard presented due to “chemical poisons entering the body through inhalation, oral ingestion, or skin penetration causing bodily harm.

Rating have the following meanings:

“0” No likelihood of producing injury.

“1” Minimum hazard. Includes most chemicals having threshold limits above 500 ppm.

“2” Some hazard, typically having threshold limits of 100 to 500 ppm.

“3” Moderately hazardous chemicals having threshold limits of 10 to 100 ppm.

“4” Severely hazardous chemicals having threshold limits below 10 ppm.

(6) Odour threshold

The smallest concentration, expressed in parts per million by volume in air, that can be detected by small by most people. This is not an absolute value. It will vary between individuals and will vary from day to day for any person. The odour of a potentially dangerous vapour may be hidden by another odour. In addition, certain vapour are likely to produce olfactory fatigue which is a deadening of the sense of smell. For these reasons, the sense of smell alone is not a reliable indicator of the presence or absence of a dangerous vapour.

(7) Lethal dose; LD50 oral and LC50 skin, and lethal concentration.

LD50 is a statistical estimate of the dosage necessary to kill 50% of over 10 months with in 48 hours. It is usually expressed in terms of the weight of poison per unit of body weight, most often as mg of chemical/kg of animal (mg/kg). The concentration of about 60 times LD50 is lethal to person.

LC50 is a concentration which, within 40 hrs., is likely to kill 50% of the test animal species. It is usually expressed as ml or mg of chemical gas of vapour/kg of animal (ml/kg or mg/kg) or ppm, 3 or c.c/m.

The values of LD50 and LC50 is a means of measuring the lethal dose and judging the conditions. So these values are substantially different from the TLV values in the purpose for using.

2.5 Fundamental material terms used on board
IRON, STEEL:

Mild steel is a high tensile steel and will continue to be the most important material in the building of chemical tankers and their cargo tanks.

Steel is attacked by only a few products, mainly acids and, of course, ballast and washing water. Steel itself contaminates very few products, one of them being high purity caustic soda. Rust, however, creates many problems with cargo contamination. Rust may contaminate a product in the form of minute particles staying suspended in viscous heavy liquids such as glycol and caustic soda. Rust may accelerate polymerisation in polymerizable products.

Rust will be soaked in with remains of previous cargoes, mainly from heavy oils, which will contaminate the next cargo. Rust will, above all, render tank cleaning much more difficult, cause delays and perhaps cargo claims.

Due to the above reasons steel is practically never used in chemical tankers without a protective coating. Coating techniques have advanced greatly in latter years. Still, however, one does not dare to use coatings for products, which are really aggressive to steel, e.g. acids (such as phosphoric acid.) One has to reckon with coating defects where corrosion will start. One exception to this is rubber linings, which have been in use a long time with corrosive cargoes.

For information on a particular product’s sensitivity to steel and rust see ref 1, appendix 1 and 5. Generally speaking, steel is resistant to alkalis, even in high concentrations (caustic soda, ammonia).

STAINLESS STEEL:

Stainless steel has increased greatly in use as tank material in later years. The motif is not only a better chemical resistance but primary it provides for a greater ease in tank cleaning and inspection. Thus cargo contamination hazards can be reduced.

The stainless properties are due to the formation of a very thin, passive layer of chromium oxide on the surface. The care of s. steel tanks aims at maintaining this protective film intact.

S. Steels possess a number of advantageous properties, rustproofness, however, is not guaranteed. It depends on the correct treatment of the tanks and on what products carried. A short review may be of interest.

Low carbon contents are required to make the steel corrosion resistant near the welds. Carbon tends to bind chromium to formchromium carbide in the heat affected zone near the welds, thus reducing the corrosion resistance locally. The addition of titanium has a neutralising effect on this process and therefore slightly higher carbon contents can be tolerated. The addition of small amounts of nitrogen increases the tensile strength of the steel considerably. Such steels are often used in more highly stressed parts such as corrugated bulkheads subjected to corrosion from both sides, where weight reduction is at a premium.

GENERAL CORROSION:

Of S. Steel from corrosive cargoes such as phosphoric acid is of a low intensity and can therefore be disregarded.

PITTING CORROSION:

Might cause severe damage. To avoid this happening it is important to choose the correct type of s. steel. Generally speaking high molybendum contents is beneficial in this respect. Pitting may take the shape of small holes, 1.2 mm. in depth and diameter to begin with. At times they are almost hidden below the surface of the steel with an “entrance hole” of only a few tenths of a mm with a cavity of 1-2 mm below. They are therefore sometimes very difficult to detect. So called dye-penetrant tests are useful for detection when one knows approximately where to look for defects. Pitting may develop in a generally corrosive surrounding, especially when the surface is disturbed or when some extra chemical aggressive agent is present such as:

- chlorides (sea water, “salt”). Contents above some 100-200 ppm are generally dangerous when together with some other corrosive agent such as phosphoric acid. Fluorides have a similar effect.
- particles of iron or other materials on the surface
- craters or pores in weld deposits.
- weld slag or slag from rolling mill
- surface defects, micro cracks, rough surfaces
- lack of oxygen renders formation of chromium oxide difficult.
- high temperatures (above ca 40 deg. cel. corrosion rates increase rapidly.

CREVICE CORROSION:

May occur in narrow spaces where the corrosive agent can enter but without circulation, with a lack of oxygen as consequence.

Typical locations:
- under bolted connections
- under cargo sediments
- under paint on a stainless steel surface.
The following rules for maintenance of s. steel apply:

1. Keep chlorides away: Avoid sea water in the tanks and rinse with fresh water carefully after seawater washing. Seawater must never be permitted to dry up and leave salt crusts on the surface. Keep the hatch covers closed and the airpipes protected to prevent seawater or a saline atmosphere entering the tanks. Preferably change footwear before entering a tank when at sea.

2. Remove any particles or sediments: such as rust, particles from grinding operations, cargo sediments (phosphoric acid) “scale”. Cargo remains to be removed as soon as possible after discharge.

3. Surface finish: Tank surface to be kept bright and free from scratches. This means that possible corrosion or other mechanical defects should be ground and polished to the original finish. Normally grinding disc “grain 80” can be used followed by a final operation with grain “120”. Local pitting of substantial dept can be welded, minor pitting ground away.

4. Inspect for corrosion after each cargo: especially tank bottoms and under deck. In order to avoid salt crystals forming on the bottom 10-20 cm. fresh water is sometimes kept in the tanks on the ballast voyage.

5. Cleaning: can normally be carried out with all common cleaning agents such as “emulsifiers”, “solvent cleaners” and alkaline cleaners as well as caustic soda.

6. Stainless steel tanks are sometimes PASSIVATED by application of 12-15 % nitric acid (HNO3). This acid is strongly oxidizing. The procedure assists in building up the passive chromium layer on the steel, thus increasing its chemical resistance. Passivation is normally carried out after tank surface repairs in order to assist the normal passivation in air. If aggressive cargoes are to be loaded within 24 hours all repairs must be passivated. In practice “passivation” with nitric acid is often used for the removal of discoloration and particle contaminations on the surface. In fact, it is being more used as a thorough cleaning agent than a passivating chemical. Use full protective suits and full mask.

7. Pickling: is the toughest way of cleaning stainless steel. This method is used for the removal of welding or discoloration from cargoes. Pickling paste, consisting of among other components, nitric acid and hydrofluoric acid shall be applied with the same precautions as nitric acid above. Pickling should be followed by passivation with nitric acid. Pickling involves a lot of work and can only be used on relatively small areas, unless carried out by specialists.

CUPROUS ALLOYS:

Copper and its alloys corrode in many cargoes and many contaminate them, e.g. styrene, phenol, vinyl chloride, aniline, ammonia solutions etc. Particularly aggressive are the ammonia compounds: they cause inter-crystalline corrosion of cuprous alloys very rapidly. The object in question disintegrates very soon. Heating coils of cuprous alloys are attacked by caustic soda (NaOH) after being used a long time. But for a limited number of voyages no serious problems seem to arise. As a general rule in chemical tankers one tries to replace cuprous alloys with stainless steel (AISI 316/317). One must remember, however, that stainless steel easily scores against s.steel in sliding contact (in valves etc.) and design accordingly, using also other materials.

MAGNESIUM AND ALUMINIUM ALLOYS:

Alloys of magnesium and aluminium should never be used in the cargo tanks area, due to their poor corrosion resistance in such environments. As sacrificial anodes these alloys are frequently used. They are severely attacked by caustic soda. Methanol will be severely contaminated by magnesium. Any anodes should be removed before loading these cargoes. Check cargoes against fef 1 or other information.

There seems to be a belief that Al,Mg alloys are spark proof materials, suitable for tank cleaning equipment etc. The truth is the OPPOSITE: “light alloys” are considerably more prone to cause incentive sparks than steel objects. When an object falls down into cargo tank light alloy oxidise at the point of contact, thus adding a reactive energy to the kinetic energy released. Hot sparks are created instead of “cold” sparks, which are created by steel objects falling down. As a flammable mixture requires a certain minimum amount of energy to trigger off an explosion it follows that “light alloys” are considerably more dangerous. Therefore: do away with cleaning gear of light alloys.

In this connection it can be mentioned that so-called spark free tools are no longer particularly commended. Tests have shown that steel tools are equally safe.
TANK COATINGS:

A modern chemical tanker has all her cargo tanks coated unless they are made of steel. The main reasons for coating are: easier cleaning and less risk for cargo contamination. The durability of properly applied and maintained coatings may be ten years or more. On the other hand, one mistake in cargo selection may totally ruin a coating. It is a matter of knowing the limitation and possibility of each type or even in each make coating. Here, the chemical build-up of coatings shall not be elaborated only the physical properties as regards resistance and application. Every paint manufacturer has his own resistance list stating approved cargoes, temperature and time limitations etc. Contact the maker if in the slightest doubt mistakes may turn out to be very costly. Many coating manufacturers give some sort of guarantee for the first two years after application.

EPOXY COATING:

Generally possess a good resistance against alkalies, seawater, wine, vegetable oils, crude oils, gas oils, lub oils and also weak acid (as in free fatty acids in vegetable oil, but acid value should not exceed 20-40). Epoxy has limited resistance against aromatic hydrocarbons (solvent such as benzene, toluene, certain alcohols (e.g. methanol), ketones (acetone) and some esters. Epoxy is sometimes indicated as resistant also to stronger acids. This may be correct, but as an applied coating one must count on “holidays” in the film, thus making epoxy unsuitable for really corrosive liquids.

Epoxy coating which has been stressed beyond their chemical resistance with strong solvents tend to soften: test with your nails. In such a case the coating must be given ample time “weather out” trapped solvents are recover its hardness before being subjected to cargo or water again. Do not try to speed up the recovery by application of heat. The top skin of the coating may then first harden, leaving trapped solvent underneath, with flaking as a consequence. Ventilate with a good turbulence in all corners of the tank. Hardness of epoxy coatings can be established by means of a standardised test using pencils of different hardness as a reference (Sw standard SIS 184-187). Adhesion of coatings to the steel is also reduced if it is overstressed by a cargo of strong solvents. There are standard test methods for the determination of adhesion by means of glued-on tablets, which are then pulled off with a recording of the necessary force.

Epoxy coatings should normally not be heated above 60-80 deg. cel. during tank washing, steaming etc. During the loaded voyage lower temperatures should be kept.

EPOXY TANK COATING:

Are made up from epoxy with an addition of coal tar. They are excellent against seawater and crude oils but should never be used in chemical tankers, light hydrocarbons of moderate solubility such as jet fuels, gas oils, gasoline may cause the tar to leak out, which may contaminate the cargo.

ZINC SILICATE COATING:

Particularly those of organic type, are very resistant against strong solvents and normally tolerate higher temperatures than epoxies. Typical products are aromatic hydrocarbons (benzene-xylene etc.), alcohols, ketones. Jet fuels may suffer zinc “pick up” from the coating to an extent which is considered a contamination. Therefore, check with ship requirements. Zinc silicate are not resistant against acids, or alkalies. The PH value of the cargo should be within the range 5.5-10.5. This means that some molasses (slightly fermented-low pH) may attack zinc silicates, as well as high contents of free fatty acids in vegetable oil or animal oils. Zinc silicate coatings may under such circumstances cause zinc pick up into the cargo. They are therefore normally suitable for edible oils for human or animal consumption. Remember that the contents of free fatty acids, and thus also the aggressively and zinc pick up, may increase during transport. Certain coatings have governmental approval for edible oils, check for PH limitations in such cases.

Zinc silicate are not suitable for long time exposure to seawater, the life span will be unduly reduced. After carriage of molasses in zinc silicate coated tanks a thorough cleaning should be carried out as soon as possible. Sour cargo remains on the tank bottom may damage the coating. Zinc silicate are only partly resistant to chlorinated compounds (e.g carbon tetrachloride, EDC, TCE). If the water content is high hydrochloric acid may develop, which will attack the coating. In a similar way hydrolyzable hydrocarbons such as esters, acetates and halogenated compounds may attack the cargo. If however, the product is guaranteed dry and the cargo tanks and piping are completely drained and dried, these products can be carried.

Alkaline tank cleaning agents (caustic) should never be used in zinc silicate coated tanks. Considerable damage can be done in one single cleaning operation. Zinc silicate stand well up against other cleaning agents such as “solvent cleaners” and “emulsifiers” unless they have alkaline additives: Check first with the maker of the cleaning product.

If a zinc silicate coating has been attacked one can often observe a thin layer of white dust on the surface, or the coating gives a porous appearance. Inform the owners at once: it may be that the last cargo was off specification and caused the damage.
PHENOLIC RESIN:

are a recent addition to the family of tank coatings. They have a wide resistance list, including strong solvents which the epoxide do not tolerate. At the same time the phenolic accept about all of the product that zinc silicate tolerate. This type of coating is likely to gain further application on board.

POLYESTER COATINGS:

Have poor resistance to solvents but are fairly resistance to weak acid and alkalies. They are not used on board in chemical tankers to any extent.

Maintain of tank coatings means, above all, not to subject the coatings to non-permissible cargoes. Check with the maker recommendations. Limitations as regard pH-values, max. temperatures and max permissible storage time on board must be followed. Let epoxies regain their hardness if softened. Generally it is not worth while to recoat an epoxy coated tank on top of and old coating, the risk for a poor bond is too great. Minor damaged areas can, with a certain degree of success, be recoated. The area must first be degreased well. The area should then be ground to a bright steel finish with a rotating grinder, grain 80 to 120, with an even transition to the coating. 1-2 coats of primer plus 3-4 finishing coats may be necessary in order to build up the proper film thickness (200-300 microns). The tank wall may have to be warmed up (preferably from behind) in order to insure that there is no risk for condensation on the surface. If possible the tank wall should be warmer than the tank atmosphere. For application of coating on a whole tank the steel bulkheads must be properly sandblasted (non marine origin sand).

RUBBER LININGS:

In recent years a number of ships have been fitted with rubber lined tanks, for the transport of phosphoric acid, waste acids and hydrochloric acid.

The mild steel surfaces to be lined should be prepared by grinding away rough weld beads, surface defects, weld splatter etc. Then comes sandblasting to “bright metal” *(Sa 2 1/2-3*), priming with a rubber glue and an application of a contact rubber glue. Thereafter the uncured rubber is applied in wide sheets and pressed on by means of hand rollers. The rubber is usually 4-6 mm thick with re-inforcements where mechanical wear may occur, such as hatches etc. The rubber is vulcanized by heating with steam or hot water for a period of 15-30 hours. Synthetic rubbers may have a curing accelerator added and will vulcanize at normal ambient temperature (20-30 deg. C.) in a few weeks.

Natural rubber has been used in ships for phosphoric acid. But chloroprene (neoprene) synthetic rubber is a more usual choice on board. It has a much better resistance to sun radiation, oils and ozon, chloroprene is however, more expensive and is somewhat more difficult to apply. Chloroprene is resistant to strong acids (not sulphuric acid) and strong alkalies such as caustic soda. In some cases chloroprene lined tanks have been used for backhauls with fuel oils. This rubber will however, not tolerate light hydrocarbons. Buthyl rubber has a very good chemical resistance but is stiff and hard to apply. Great caution must be exercised so that the rubber will not be subjected to mechanical damage due to falling objects, tools etc., Rubber lined tanks should have a minimum of fittings such as brackets, ladders, internal piping etc. which can create weak spots. Steel piping includes bends can be rubber lined. The pipe diameters should be chosen somewhat liberally in order to keep liquid velocities relatively low. Membrane types of valves as well as pumps can be lined with hard rubber. As heavy wear may occur on these parts the use of s. steel is however recommended. The advantage of having a pure rubber lined system with regard to a possible high contents of chlorides in the product will then, however, be lost see 4.02 Rubber linings are tested for pores and defects by means of a high voltage tester at 10000 V (Chloroprene) and 20000 V (natural rubber). To check the progress of curing or aging a shore durometer is used. Shore tanks are sometimes lined with PVC (poly vinyl chloride) sheets glued into place. But this technique does not seem to be sufficiently developed for use on board ships.

MARINE LINE:

MarineLine is the only high performance lining that withstands all IMO approved chemical cargoes. Advanced Polymer Coatings formulates MarineLine with “patented” Siloxirane polymer resin which resists an extensive range of acids, bases, solvents and salt water, and which handles the tough operating conditions inherent in maritime chemical tankers.

MarineLine's unique cross-linked polymer structure does not allow a chemical cargo to permeate the lining. This answers the critical needs for assuring product purity and for resisting corrosion.

Maritime transporters gain flexibility by using just one lining to accommodate all different types of cargoes without requiring stainless steel tanks or a range of specialty coatings such as phenolic epoxies or inorganic zinc silicates. In addition, more profitable cargoes can be carried due to MarineLine's exceptional performance features.
Smooth surface is usually easily cleaned without solvents or cleaning agents once the tank is discharged. Sometimes, only a short butter-worthing is needed to drain out any residue to prepare the tank for the next cargo. This provides a safer working condition, a faster, more efficient turn-around during port changes, and the elimination of claims for failing to meet cargo purity requirements. MarineLine's toughness and superior bonding strength, even to pitted/corroded steel, is of paramount importance in moving, twisting ships. MarineLine also delivers long service life by effectively protecting vessels against corrosion. The cost of applying MarineLine is relatively small when compared to the cost of ship deadtime when using phenolic epoxy or zinc silicate coatings.

GASKETS AND PACKINGS:

When PTFE (poly tetra fluoroethylene ,trade names : teflon,fluon,) came on to market a few years ago it solved many gaskets problems. This material is resistant to all likely chemical cargoes and all common temperature on board. The PTFE has some very typical properties :it is expensive ,has a low frictional resistance and a low thermal conductivity ,does not adhere to other materials and yields or creeps when under pressure. PTFE as a gasket in flange connections should either be reinforced (asbestos,or glass fibres),contained in a groove (male/ female) or used as a relatively thin envelope around a core of more conventional gasket material. Creep can be controlled "blue " asbestos generally gives better chemical resistance against (pH 1-4 ) than "white “ asbestos .In “envelope” gaskets the cargo comes into contact with PTFE only ,which is an advantage.

It is an advantage to use PTFE packings in pump and valve spindle gland boxes, but remember that the bottom clearance between spindle and housing may have to be less than usual as the packing will have a tendency to creep out this way.

Although PTFE will solve most problems one must remember that common ,and cheaper,materials will often suffice.If an existing oil tanker is to carry strong solvents (e.g aromatics,ketones etc.) flange gaskets of asbestos -reinforced synthetic rubber will usually be acceptable. Flange gaskets of synthetic rubber -asbestos will normally stand up against strong solvents ,alcohols, strong alkalies(caustic) and acids .If in doubt ,check with the maker. Expansion glands in cargo piping and valve spindle glands , however should be repacked with PTFE -asbestos packing.

Rubber gaskets are not suitable for oils or solvent .Rubber is suitable for phosphoric acid. Chloropene rubber (neoprene) is resistant to caustic soda and ammonia solutions. Carbon fibre : spindle packing are sometimes used in high speed pump glands. They are expensive but have the advantage of low friction, chemical inertness and high thermal conductivity.

Nitril and flour (Viton) rubber : have a very good chemical resistance to strong solvents as well as and are used particularly in O-rings for stem seals in valves.

2.6. CHEMICAL DICTIONARY

ACID NUMBER: (Neutralization number) Number of milligrams of potassium hydroxide required for neutralization of free fatty acids present in 1 gr of fat or oil ,a measure of free acids present in a substance.

ALCOHOL: (OH) Organic compounds containing one or several hydroxyl radicals (OH) .Alcohols may be mono-,di-,tri-,etc,according to the number of hydroxyl radicals they contain and primary,sec.,tert. According to position of hydroxyl radical.

ALDEHYDES: A groupof organic compounds containing the –CHO,radical and holding a position betw een alcohols and acids. They are produced by the oxidation of hydrocarbons (e.g alcohols) and can be used for production of alcohols.Example:acetaldehyde (CH₃CHO)

ALKYL: A non- cyclic saturated hydrocarbon of general formula CₙH(2n+1) dir.

ALIPHATIC: Organic compounds in which the carbon atoms are not arranged in a ring structure

ALKANES (ALCNES): Aliphatic saturated hydrocarbons of type CₙH(2n+2)

Example: Pentane - C₅H₁₂

AMINES:Substances derived from from ammonia where the hydrogen atoms are replaced by one ,two or three alkyl groups.

ANTIFREEZE: Usually glycol derivatives.

AROMATICS: Aromatic hydrocarbons(benzene hydrocarbons),unsaturated,with the carbon atoms in rings with a 6 carbon nucleus ring. Example :aniline,naphthalene,benzene,toluene,xylene

CARBONYL GROUP: The group CO which is a characteristic of aldehydes and ketones..

CARBOXYL GROUP: The characteristic part of most organic acids,eg fatty acids.

BRIMSTONE: Other name of the sulphre.

CHLORINATION: The treatment with or introduction of chlorine into a compound.

CHLORINATED HYDROCARBONS: A type of halogened hydrocarbon. The position of 1 chlor atom has replaced with 1 hydrogen atom.

COLOUR DETERMINATION: Explanation of the colour and condition of the chemical products .No any contamination is observed.
DERIVATIVE: A compound obtained from another compound by a simple chemical reaction; an organic compound containing a structural radical similar to that from which it is derived e.g. benzene derivatives containing the benzene ring.

ESTERS: An organic compound (salt) formed from an alcohol (base) and an organic acid. Many esters occur in nature e.g. fats. Many esters are important as solvents.

ETHANOL: Ethyl alcohol (spirit, spirit of wine, grain alcohol, absolute alcohol).

FATTY ACID: Organic monobasic aliphatic acids. The three acids occurring most frequently in fats as glycerol esters: palmitic, stearic and oleic acids. Fatty acids are common in animal and vegetable tissue and are obtained by boiling or extraction; they are used in edible oils and fats, soap manufacture etc.

GLYCOLS: Aliphatic secondary alcohol compounds containing 2-OH groups. Ethylene glycol, colourless liquid, produced from ethylene (oxide). Antifreeze, used in polyesters, cosmetics.

HALOGENS: The chemically related elements fluorine, chlorine, bromine and iodine. Combined with hydrogen they form acids (e.g. HCl) and with metals salts (e.g. NaCl).

HYDROCARBONS: Combination of carbon and hydrogen. The most important: Paraffins; saturated aliphatic hydrocarbons incapable of combining further with hydrogen or halogens and comparatively indifferent to chemical action. Liquid paraffins soluble in alcohol and ether but not in water.

HYDROGENATE: To introduce hydrogen into a molecule, as the saturation of unsaturated compounds.

HYDROLYSIS: A chemical reaction in which water reacts with another substance to form one or more new substances (e.g. hydrolyzable solvents) such as acetates, esters, halogenated compounds (often chlorinated) may with water form organic or inorganic acids.

ISO: A prefix indicating a similarity.

KETONES: A class of organic bodies produced by oxidation of secondary alcohols and characteryzed by the carbonyl group (CO).

MINERAL ACIDS: Strong inorganic acids e.g. sulphuric, nitric and phosphoric acid.

MINERAL OIL: Mixture of liquid hydrocarbons obtained from petroleum.

MONO: A prefix indicating “one”.

ODOUR: The smallest concentration of gas or vapour in air.

OXIDATION: An element contaminated with oxygen.

OLEFIN: A class of unsaturated hydrocarbons. They are characterized by relatively great chemical activity.

POLYMERISATION: The phenomenon whereby the molecules of a particular compound link together into a larger unit containing anything from two to many thousands of molecules; the new unit being called a polymer. A compound may thereby change from a free flowing liquid into a viscous one or even a solid. A great deal of heat may be evolved when this occurs. Polymerisation may occur spontaneously with no outside influence, or it may occur if the compound is heated, or if a catalyst or impurity is added. Polymerisation may, under some circumstances be dangerous but may be delayed or controlled by the addition of inhibitors.

SOLVENT: In Chemical trading usually the name for products used in industry for dissolving other substances. Examples: acetone, alcohols, glycols, benzene, petrol (gasoline), naphtha, carbon tetrachloride, turpentine, carbon disulphide, cyclohexanol.

VAPOUR DENSITY: This is actually a specific gravity rather than a true density because it equals the ratio of the weight of a vapour or gas compared to the weight of an equal volume of air at the same temperature and pressure. Values less than 1 indicate that the vapour or gas tends to rise and values greater than 1 indicate that it tends to settle.

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CHAPTER 3

CARGO OPERATIONS PLANNING

3-1. Guidelines for determining the cargo loading

Cargo loading planning should be taken into account the cargo information and the precautions prescribed in this chapter. For this purpose of loading planning complying with the IMO Chemical Code, followings are prescribed in this chapter.

(a) Flow-chart for cargo stowage planning
(b) Precautions about each item specified in this flow chart
Furthermore, to make an actual cargo loading planning, the following booklet are well understand.
(c) SHIP OPERATING BOOKLET
(for ship’s intact stability and longitudinal strength)
(d) LOADING MANUAL for DAMAGE STABILITY
(for IMO Chemical Code)
(e) DATA SHEETS of the INTENDED CARRYING CARGO
(for IMO Chemical Code, mainly included with data sheets of intended carrying cargoes. Obtain cargo information from Chemical Data Guide- USCG publication- and display it in Turkish and English in the specified place(s) on board, for Crew information throughout the cargo operation. For this purpose use GF-6.01 E)

The ship’s Master and responsible officers should well understand these three booklets, for a good cargo stowage planning.

3-2 Flow-chart for Cargo Loading Planning

In case planning an actual cargo stowage, following two stages should be considered.

(First stage)
Arrangement of tanks loaded with intended products respectively

(Second stage)
Distribution of cargo weight.

Flow-chart of each stage are as follows and only loading plans meeting the all items in the following flow-chart could be permitted as the ones complying with the IMO Chemical Code.

3-2-1 Guidelines For Cargo Planning

1-Load the vessel so that positive trim is ensured during discharge, preferably without filling ballast in cargo tanks, particularly not in port. Try to find out the receiver’s desired sequence of discharge. Keep an eye on hogging / sagging.

2-Inter-reactive cargoes must not be placed in neighbouring tanks. Piping systems must be separated by double blind flanges to prevent erroneous handling of valves. Check the cargoes with data sheets in ref 1 and appendix 3 for cargo compatibility.

3-Toxic cargoes must not be placed in neighbouring tanks with edible products (human or cattle). Separate the piping systems by means of double blind flanges.

4-Check with the tank coating manufacturer’s list of permissible cargoes for coatings in each tanks. The general rules are:
Zinc silicate coatings are not resistant to caustic soda or alkaline cleaning chemicals. Epoxy coatings are resistant to petroleum products, caustic soda, vegetable oil, wine, seawater, fatty acids, limited resistance to alcohol and aromatics. Coal Tar epoxy is resistant to seawater, crude oil and petroleum products in general but should not be used for jet fuels or light oil as they tend to be contaminated by bleeding tar.

5-In certain cases the tank coating manufacturer gives a limited acceptance for a product (time and/or temperature). Avoid then placing heated products on the other side of the bulkhead. Let epoxy weather out properly after solvent cargoes. Do not fill ballast water immediately after methanol in the same tank.

6-Polymerizable products (e.g., styrene, vinyl chloride) should never come in bulkhead contact with heated cargoes. The same refers to drying vegetable oils (e.g., linseed oil).
7-Volatile products (aromatics, ketones, alcohols etc.) should not be put into bulkhead contact with heated cargoes in order to avoid unnecessary evaporation losses.

8-The cargo tanks are normally inspected and approved prior to loading. This does not necessarily relieve the vessel of responsibility for contamination. The master/owner carries the responsibility in taking due care of the cargo. To protect one’s own interest the vessel’s own inspections should be recorded in the deck log. Also ensure that the cargo tanks and associated piping systems; valves, etc. are adequately cleaned for carriage of the nominated cargo (es) and report the readiness to the company. (GP-6.04) and ensure water-tightness of all tank openings by checking the packing of tank hatch covers and butterworth lead covers.

9-After cargoes with a strong odour (fish oil, phenol, octanol, tall oil, turpentene, molasses) the tanks should not be used immediately for odour sensitive cargoes such as glycols, vegetable oils.

10-After leaded gasoline, cargoes for human or animal consumption must not be loaded as the next cargo, neither “virgin naphta feedstock”. Lead compounds may adhere to the bulkheads after several intermediate cargoes even in coated tanks. Wine cargo may dissolve lead remains, which are many intermediate cargoes “old”.

11-In case of doubt of purity of cargo to be loaded take cargo samples also from the loading manifold upon loading and have them sealed and identified for future reference.

12-In tanks which have contained products with a high boiling point and/or low water solubility (e.g lubrication oils) there will be minute amounts of cargo left after washing. These tanks are then not suitable for a “sensitive” cargo such as methanol.

13-Consult the cargo trim and stability book. There may be restrictions with regard to cargo distribution and stability in hypothetical damaged condition.

14-When one and the same pipe has to be used for several consecutive products: start with the lighter products, going on to more viscous ones. The pipe may have to be drained and steamed in between, therefore try to arrange an open loop. The most sensitive cargoes may have to be loaded “over top” through the hatch.

15-Double valves are usually not considered as a sufficient means of segregation in the chemical trade. Blind flanging is necessary. Provisional blind flanges can be made of 2-3 mm. sheets, preferably stainless steel. Observe: reactive cargoes need more substantial segregation see2/3

16-When two cargo parcels cannot be segregated by means of blinds the liquid level can purposely be kept higher for one of the products, thereby ensuring that any possible leak will go in the less dangerous direction with regard to contamination damage.

17-Check cargo valves for tightness prior to loading and take leaking valves into consideration when placing cargoes.

18-Blow heating coils over deck prior to loading to ensure that no cargo has leaked into them which could cause danger in the engine room when heating is commenced. Pressure test the coils before loading.

19-Heating coils (steam) should be blind flanged towards the engine room when products are carried which do not require heating.

20-Before loading water-sensitive cargoes (halogated compounds; e.g trichloroethylene) or chloride-sensitive cargoes (alcohols, glycols): hose test the tank hatches for tightness and check valve spindle glands on weather deck.

21-Inform the owner if there seems to be a disagreement between B/L product and the product actually loaded (may affect freight, cleaning costs, safety).

22-Avoid carrying the most toxic products as last cargoes before drydocking and shipyard work.

23-Cargo tanks should be never loaded over 98.5%.

24-High level alarms should be always on during loading/discharging operations.

3-3 Method of separation loading
To establish whether or not two cargoes will react dangerously together, the data sheets and reactivity table of this Manuel for both cargoes should be consulted.

When the data sheet indicates that a dangerous reaction may result by mixing the cargo in question with another, “double” separation should be provided as greater security against accidental mixings.

“Double” separation involves:

(I) a pump room, cofferdam or similar void space (which may be an empty cargo compartment) between tanks or compartments containing incompatible cargoes, or at least one compartment loaded with a cargo compatible with each, and separating, the incompatible cargoes, and

(II) independent cargo pipelines to each compartment containing incompatible chemicals and which do not pass through any compartment containing other incompatible cargoes unless the pipeline is in a tunnel or similar arrangement.

(III) independent vent systems on each compartment containing incompatible cargoes.

Guidance when sufficient reactivity data is not available

Those responsible for soliciting, booking and scheduling parcel cargoes of chemicals should always satisfy themselves that various parcels scheduled for any given voyage of any given ship are mutually compatible and can safely be loaded and carried within the normal segregation of the ship. Since the ultimate responsibility for safety of the vessel lies with the master, he should ensure himself by inspection of the data sheets that the cargo distribution proposed for any voyage provides proper segregation of all parcels from stand point of compatibility. If the data sheets do not provide the necessary information, The Master should defer loading of the cargo until he has been able to consult with his Owner, and received satisfactory assurance that the cargoes to be loaded and the proposed plan of segregation are indeed compatible and safe.

It can not be emphasised too strongly that parcels of chemicals should not be accepted for shipment or loaded on a vessel unless positive assurance is available that the various chemicals are compatible within the basic pattern of the vessel itself.

### 3.3.1 Separation from fuel oil tank

Cargoes which applies paragraph 15.11, 15.11.6, 15.12, 15.12.3, 16.6 and 16.6.1 have to be separated from fuel oil tank. Method of separation is similar to above mentioned separation of dangerous reaction, but from the point of view of this ship’s tank arrangement, cargo tanks of this ship are not arranged adjacent to fuel oil tanks, this item may be ignored.

### 3.3.2 Separation from other cargo tanks loaded with heated cargoes

The ship intends to carry a reactive cargo e.g.

- Acetone cyanohydrin,
- Acrylamide solution (50% or less),
- n-Butyl acrylate,
- Crotonaldehyde,
- Decyl acrylate,
- Ethyl acrylate, 2-
- Hydroxyethyl acrylate,
- Isobutyl acrylate,
- Methyl acrylate,
- Methyl methacrylate,
- alpha-Methylstyrene,
- Acrylic acid,
- Butyl / Decyl / Cetyl / Eicosyl methacrylate mixture,
- Butyl methacrylate,
- Cetyl / Eicosyl methacrylate mixture,
- Dodecyl / Pentadecyl methacrylate mixture,
- 2-ethylhexyl acrylate, Ethylidene norbornene,
- Ethyl methacrylate,
- 1,3- Pentadiene,
- Styrene monomer,
- Vinyl acetate,
- Vinyl neodecanoate and Vinyl toluene as defined para. 16.6 or 16.6.1 of IMO Chemical Code.

Heated cargoes should never be loaded adjacent to such self reactive cargoes, since excess heating of self-reactive cargoes will shorten the life of the stabilizing inhibitor making a self-reaction possible.
It is recommended that stowage of heated cargoes adjacent to tanks containing poisons are avoided, minimising the possible evolution of poisonous to the deck.

### 3.3.3 Separation from tanks contained with water

The data sheets indicates of a dangerous reaction is possible between a chemical and water. If such a reaction is possible “double” separation between the chemical and water is recommended. For instance, Toluendiisocianate, Nitrating acid (mixture of sulphuric and nitric acid), Oleum, Sulphuric acid and Trimethyl phosphite these cargoes are reacted with water dangerously, Acetonitrile, Carbontetrachloride, Dichlороethylene, Ethylaerylate, Ethylene dichloride and Vinyl acetate these cargoes are may be occur hydrolysis causing increased corrosivity.

Therefore, cargo tanks loaded with above cargoes must be separated from tanks loaded with water. When above products are carried, these cargo tanks should be completely cleaned without residue of water.

### 3.3.4 Prohibited contaminate with Alkaline or Acidic materials

Cargoes requirement in para. 15.16 or 15.16.1 of IMO Chemical Code, alkaline or acidic materials, such as Sodium hydroxide solution or Sulphuric acid should not be allowed to contaminate these cargoes. Objective cargoes among the intended carrying cargoes of this ship are e.g. Acrylamide solution (50 % or less), Crotonaldehyde, Calcium hypoclorite solution, Ethylidene norborne, Formaldehyde solutions (45% or less), Trichloroethylene and Vinyl neodecanoate

### 3.3.5 Loading limitation of cargo

(1) Maximum allowable quantity of cargo per tank in accordance with ship type required by cargo.

The quantity of a cargo required to be carried in a type 1 ship, should not exceed 1.250 m$^3$ in any one tank.

The quantity of a cargo required to be carried in a type 2 ship, should not exceed 3.000 m$^3$ in any one tank.

As this ship is type 2&3 ship and any cargo tank capacity per tank is not exceed 3.000 m$^3$, this ship is not restricted by this limitations.

### 3.3.6 Filling limit from the point of closhing strength

Generally, from 10 % to 90 % filling ratio of half loading is prohibited in order to avoid sloshing, where tank’s breadth exceeds 60% ship’s one, or tank’s length exceeds 10% Lf (ship’s length) or 10, whichever is larger.

### 3.3.7 Cargoes which have vapour pressure greater than 1.013 bar at 37.8 C

These cargoes must be apply the para. 15.14 of IMO Chemical Code. There are no products among the intended carrying cargo of this ship.

### 3.3.7.8 Preparation of loading

After completion cargo planning, Chf officer should be carried-out,

- prepare a loading plan as exampled on the GF-6.01 A and deliver the copies to the junior deck officers and the Bosun/pumpman with their counter signature on your copy which has to be kept in ship’s file.
- Check all cargo pumps by instant START/SHUT OFF to see that they are in good working order.
- Check all supplementary devices on the cargo system to see that they are operating properly.
- Perform the crack test on the cargo pipes and associated piping systems such as P/V valves.
• Check the cargo tightness of the flanges on the piping system for preventing leakage.

At approaches to load port, carry out the following to the permission of the circumstances and if vessel is berthing directly;

• The cargo valves, lines and manifold settings will be done by the pump man for the intended loading plan, and the settings must be cross checked by the Chief Officer / Cargo Officer on duty.
• Get cargo tanks ready for surveyor’s access and examination. Ensure by gas and oxygen analyzers that the tanks are safe to enter in. (Entry into Enclosed Spaces GF-4.04 B)
• Get scuppers plugged in.
• Ensure that all flanges are fully bolted without missing ones.
• Get main deck clean and safe, wiping away any oil on deck or any obstacles that may prevent safe action on deck.
CHAPTER 4

SAFE LOADING PRACTICES

4.1 OVERFLOW PREVENTION SYSTEM FOR CARGO TANKS

General

4.1.1 Particulars of the ship

Applicable Code and outline of the construction and equipment of the vessel IMO Code 4.14.1 High level alarm
This issues alarms when the liquid level reaches 97% of the tank capacity, and alarms are given in audible sounds and visible lamps in the cargo control room and displayed on the special panel for HLA. IMO Code 4.14.2 High high level alarm
This issues alarms when the liquid level reaches 98% of the tank capacity, and alarms are given in audible sounds and visible lamps in the cargo control room and displayed on the special panel of HHLA. In addition, for those duty officers of the ship, alarms are announced by the air phone and satellite (in red) provided on top of the wheelhouse.

4.1.2 Operational supervision and assignment of duties

Normal stations and assignments including means of liaisons
Operational supervisions and work assignment
Supreme commander for cargo work.................................................................Captain
Commander of actual cargo work.................................................................Chief Officer
Person in charge of the maintenance and operation of the cargo pumps, hydraulic units of cargo related auxiliaries, pneumatic clutches and hydraulic lines...............................................................Chief Engineer
Person in charge of control of protective equipment of cargo work................Second Officer

4.1.3 Cargo handling procedure

Precaution before cargo loading
Meeting with shore party
Loading rate

For loading cargo subject to the requirements of the IMO Dangerous Chemicals Code 1.14.2, the shipboard personnel who is responsible to cargo loading should determine the loading rate by pressure drop calculation provided from p/v valve manufacturer which calculated based on ship’s specific p/v and vapor control arrangement for good mutual consent in a meeting.

(A) Determination of loading tanks and lines Captain
Verification of loading plan Chief Officer
Trim and stability calculations Chief Officer and OOW

(B) Cargo loading work
General command and supervision Chief Officer
Assistant OOW
Cargo hose connection OOW, Boatswain and Pumpman
Bonding wire connection OOW
Application of scupper to deck scuppers Sailors & Bosun
Cargo related valve handling OOW/ P.Man

Operation test of level alarms OOW and P.Man
Verification of complete readiness for cargo operation Chief Officer
Giving notice of readiness for cargo operation to the shore party Chief Officer
Shipboard communications with those crewmembers should be affected by 1 and 2 above, and ship to shore communications should be made verbally or through the shore party's telephone set placed on board the ship, or through the nearest telephone boot available on shore, or through the use of transceivers.

4.1.4 Precautions during cargo loading

Ship's work stations

| Task                                                                 | Responsible
|----------------------------------------------------------------------|----------------
| Inspection of abnormalities on loading lines                        | OOW            |
| Verification of operation of vent lines                             | Pumpman & OOW  |
| Monitoring the loaded volume of cargo                               | OOW            |
| Giving notice to the shore party before completing the scheduled volume of cargo | Chief Officer |
| Giving request to stop pumping to the shore party on reaching the scheduled liquid level of cargo | Chief Officer |
| Verification of cargo loading volume with the shore party            | Chief Officer  |
| Disconnecting bonding cables                                        | OOW            |
| Disconnecting cargo hoses                                           | OOW, Pumpman/Boatswain |
| Unplugging deck scuppers                                           | Bosun/ Sailors |
| Verification of completion of cargo loading                         | Chief Officer  |

Valve operation (consideration against pressure surging, etc.) One of the major causes for pressure surging against the flow of high speed liquid within the piping lines is in the abrupt valve closing operation (either partial or total closure). Accordingly

a. Cargo flow control during the loading operation should be affected through the use of the operating valve of the terminal located at the ship to shore connection or by regulating the cargo loading pump speed.

b. Before shutting off the cargo flow by closing the operating valve of the terminal, ship's valve should never be closed under any circumstances.

c. In this connection, agreement should be reached between the ship and the shore parties on the ship.

In the event of occurrence of abnormalities such as power failure in the cargo loading system or loss of communications connected there to other than over flowing accident, the following emergency procedures should be taken to counter the situation:

Chief Engineer

------- Liaisons on failures on the equipment or power failure

Chief Officer

------- Liaisons for requesting to make emergency stopping of the shore pump

Shore representative------ Emergency stopping of the pump

------- Liaisons for making emergency stopping of the pump

Chief Officer-------- Emergency closure of valves

------- Liaisons for verifying the valve closure

Shore representative
4.1.5 Precautions at the termination of cargo loading

Ship's work stations
Cargo valves operation Officer OW, Pumpman & Sailors following signals relative to cargo handling in a meeting in advance:

"Start cargo loading"

"Drop flow rate"

"Stop loading cargo"

"Emergency stop"

On the foregoing system of ship-shore communication, complete understanding on both parties should be ensured at every shift of watch duties or at every shift of working gangs of the shore party through mutual verification by the duty officer of the ship and the responsible personnel of the shore party to see if the watch personnel at the ship/shore connection are fully aware of such signalling system.

4.1.6 Emergency procedures

(Procedures when the overflow control system comes into action) Normal cargo loading stopping procedures on coming into action of the HLA

```
Issue of HLA (start)
------------------- Signals by buzzer and lamp
Ship operator
------------------- Liaisons on issue of HLA alarm
Chief Officer
------------------- Liaisons for requesting the pump to stop
Shore representative-------------------stop the pump
------------------- Liaisons on the stoppage of the pump verified
Chief Officer
------------------- Instructions to close the valves
Ship operator-------------------Close the valves
------------------- Liaisons on the closure of the valves verified
Chief Officer
------------------- Liaisons on the closure of the valves verified
```
Emergency cargo loading stopping procedures on coming into action of the HHLA

Issue of HHLA

- Signals by air phone, satellite signals, buzzer and lamp

Ship operator

- Liaisons on issue of HHLA alarm

Chief Officer

- Liaisons for requesting the pump to emergency stop

Shore representative

- Emergency stop the pump

- Liaisons on the emergency stoppage of the pump verified

Chief Officer

- Liaisons on the emergency closure of the valves verified

Ship operator

- Emergency closure of the valves

- Liaisons on the emergency closure of the valves verified

Chief Officer

- Liaisons on the emergency closure of the valves verified

Shore representative

(Finish)

4.1.7 Inspection and maintenance of the installations and reference materials Inspection / maintenance.

The inspection and maintenance procedures of the installations should be in accordance with the manufacturer's service manual. General reference materials
See the attached manufacturer's drawings for system diagram of the installations and detailed drawings.

4.2 DECK WATCH IN PORT

4.2.1 Basic Principles To Be Observed In Keeping Watch In Port

On any ship safely moored or safely at anchor under normal circumstances in port, the Master shall arrange for an appropriate and effective watch to be maintained for the purpose of safety.

The Master of every ship carrying cargo in bulk, that is hazardous whether it is, or maybe, explosive, flammable, toxic, health threatening or environment polluting, shall ensure that a safe deck watch and safe engineering watch are maintained by the ready availability on board of a duly qualified officer or officers, and ratings where appropriate, even when the ship is safely moored or safely at anchor in port.

In organizing the watches, note shall be taken of the provision of the "Recommendation on Principles and Operational Guidance for deck Officers in charge of a watch in port" and the "recommendation on principles and Operational Guidance for Engineer
4.2.2 Watch Arrangements

Arrangements for keeping watch when the ship is in port should:
Ensure the safety of life, cargo and port;
Observe international, national and local rules;
Maintain order and the normal routine of the ship;
Prevent Pollution

4.2.3 Composition Of The Watch

The Master shall decide the composition and duration of the watch depending on the conditions of mooring, type of the ship and character of duties.

4.2.4 Officer In Charge

A qualified deck officer shall be in charge of the watch and the necessary equipment should be so arranged as to provide for an efficient watch keeping.

4.2.5 Handing Over The Watch

The officer of the watch should not hand over the watch to the relieving officer if he has any reason to believe that the latter is obviously not capable of carrying out his duties effectively, in which case he should notify the Master accordingly. Also Harbour watchkeeping hand over check list for deck officer must be filled upon watch hand over

4.2.6 Handing Over The Watch During Important Operations

If, at the moment of handing over the watch, an important operation is being performed it should be concluded by the officer being relieved, except when ordered otherwise by the Master.

4.2.7 Information To Be Given When Handing Over The Watch

The relieving officer should be informed of the following by the officer being relieved:
The depth of water at the berth, ship's drought, the level and time of high and low waters; fastening of the moorings, arrangements of anchors and the slip of the chain, and other features of mooring important for the safety of the ship; state of main engines and availability for emergency use; All work to be performed on board the ship; the nature, amount and disposition of the cargo loaded or remaining, or any residue on board after unloading the ship; The level of water in bilges and ballast tanks; The signals or lights being exhibited; The number of crew required to be on board and presence of any other persons on board; The state of fire fighting appliances; Any special port regulations; The lines of communication that are available between the ship and the shore staff or port authorities in the event of an emergency arising or assistance being required; Other circumstances of importance to the safety of the ship and protection of the environment from pollution.

4.2.8 Relieving Officer-Verification

The relieving officer should satisfy himself that:
Fastenings and moorings or anchor chain are adequate; The appropriate signals or lights are properly hoisted and exhibited; Safety measures and fire protection regulations are being observed; He is aware of any hazardous or dangerous cargo being loaded or discharged and the appropriate action in the event of any spillage, fire or human casualties; No external conditions or circumstances imperil the ship and that his own ship does not imperil others.
4.2.9 Regular Inspections

The officer of the watch shall make rounds, or delegate responsible crew to inspect the ship at appropriate intervals. He shall pay particular attention to:

The condition and fastening of the gangway, anchor chain or moorings, especially at the turn of the tide or in berths with a large rise and fall and, if necessary, take measures to ensure that they are in normal working conditions;
The drought, underkeel clearance and the state of the ship to avoid dangerous list and/or trim during cargo handling or ballasting;
The state of the weather and sea;
Observance of all regulations concerning safety precautions and fire protection;
Water level in bilges and tanks;
All persons on board and their location, especially those in remote or enclosed spaces; The exhibition of any signals or lights;

4.3 MOORING

4.3.1 General

The trading area of most vessels require that they can be safely moored at piers and sea islands. In certain areas, where cargo is loaded from or discharged into a submerged pipeline, multible buoy mooring is the common practice.

The master shall determine the mooring pattern and the number of hawsers required. The objective of an efficient Mooring pattern is the safe mooring, unmooring and tending of lines while docking undocking and during cargo operations, taking into account the various forces acting on the vessel. To maintain the position of the vessel's manifold connection as steady as possible thus preventing any damage to cargo hoses and or loading arms. To allow for safe mooring of tugs or equipment used in guiding vessels through canals or assisting with going alongside.

A safe connection a salvage tug to the disablet vessel with minimum risk of damage to the tow, the environment and the personnel involved in such operation.

MOORING CHECK LIST should be filled by chief officer before/after mooring operations.

4.3.2 Forces Acting On Ship

The vessel while moored at a pier, sea island or multiple Mooring Buoy arrangement is exposed to various forces. These are defined as swell, current, wind and any traffic passing by. These factors have to be considered when selecting a mooring pattern and the Master shall allow for sufficient reserve in breaking strenght.

4.3.3 Material Of Hawsers

All managed vessels are fitted with "MIixed Polypropylene/Polyester" hawsers of 5 to 8"Circumference. (Depends on vsl. Size) These hawsers provide sufficient strenght for all mooring operations within the trading areas of vessels managed by ATS SHIPPING AND TRADING INC. Since only one type of mooring is available, a mixing of different types of mooring can under normal circumstances not be done.

4.3.4 Mooring Pattern

The Master shall select the appropriate pattern when mooring the vessel. An equal NUMBER, TYPE and SIZE of mooring lines same direction shall be selected. Three head lines, two forward spring lines and the same configuration of stern lines and aft springs are considered the minimum requirement when mooring a vessel in calm enclosed waters.

4.3.5 Fastening Of Mooring Lines
Officers have to supervise the operation at each mooring station. A competent person tend each winch control which is in operation. Sufficient persons must be available to run out the moorings. A person to tend any rope being hove in on a drum end, with a second person available to clear to bigghts of rope away from the winch area and apply stoppers as required.

Hawsers shall be turned around the bits 2 full turns (but not more) on leading post before figure eight. This method allows better control of the rope, is easy to use and is safer (See figure ). Mooring lines shall be fastened on the proper bits or on the mooring winch drums. The lines shall not remain on the spill heads of the winches. Lines reeled on mooring drums shall not remain on heaving up/leaving loose position. The angle of dip between ship and shore must not be excessive.

Other topic is using and storage ropes in mooring drums. The common mooring drum divided by a notched flange into a wire storage section and tension section. It is operated with only one layer of rope on the tension section and theoretically can maintain a constant, high break holding power.

The split drum which was designed as a solution to the spooling problem encountered with undivided drum winches. When wires are handled directly off drums, the final turns of the outer layer when under tension tended to bite into the lower layers. In operation, the rope from the split drum winch is sent ashore first from the working half and then directly from the storage half. As the rope is recovered, it is wound directly on the stowage half until that time when only sufficient slack rope is available to provide a sufficient number of turns on the tension drum to: (1) hold the tension of the rope on the tension drums only and (2) provide extra turns to allow for adjustments of the line throughout cargo transfer. At that time the rope is fed through the slot from the storage portion to the tension portion.

The important point of operation is reeling direction and number on split drum. A band brake is designed to work in one direction only. Therefore the line must always be reeled correctly on to drum. The line is properly reeled if it is pulling against the fixed and of the brake strap. Reeling the line on to drum in the wrong direction may reduce the brake holding power by up to %50. Whinch drums should be marked to indicate the correct reeling direction.

Disc brakes work equally in either direction.

Number of layer which effects the brake holding capacity onto split drum must be not more than one layer.
4.3.6 Responsibility

Deck officer; prepare mooring stations for anticipated port of call and confirm functioning of the mooring equipment. Securing mooring lines, anchors and other mooring equipment after departure from a port. Inspection of hawsers and identification of any defects to the mooring equipment. Mooring lines that has been parted during port stay must be spliced together preparations to the next docking port.

Officers and crew have to be aware safety hazards deatiled below.
* Mooring lines can pose a greater danger to personnel if not properly used. Handling of mooring lines has a higher potential accident risk than most other shipboard activities.
* The most serious danger is snap-back, the sudden release of the static energy stored in the stretched synthetic line when it breaks.
* When a line is loaded, it stretches. Energy is stored in the line in proportion to the load and the stretch. When the line breaks, this energy is suddenly released. The ends of the line snap-back, striking anything in their path with tremendous force.
* Snap-back is common to all lines. Even long wire lines under tension can stretch enough to snap-back with considerable energy. Synthetic lines are much more elastic, increasing the danger of snap-back.
* Synthetic lines normally break suddenly and without warning. Unlike wires, they do not give audible signal of pending failure; nor do they exhibit a few visible broken elements before completely parting.
* Line handlers must stand well clear of the potential path of snap-back, which extends to the sides of and far beyond the ends of the tensioned line.

4.3.7 Details

Before docking;
Weather and sea permitting but at least 2 hours prior to arrival at aport the duty officer shall prepare the forward as well as the aheat mooring stations for the upcoming docking.
The mooring lines required for the docking shall be arranged on deck and inspected for damages that may make them unstable.
Rope Stopers should be inspected for wear and tear and secured at each set of mooring bits in used.
Anchor cement and lushing must be removed and the anchor made ready for use.
The winches shall be tested and condition of the winch brakes should be examined, defects to, leaks and malfunctioning must be reported.
Public address and held portable radios are tested and satisfactory working condition.
Prepare messenger lines and spare heaving lines.
Confirm from the master side of docking and docking procedures.
Log book entry should be made that procedures was used.
During mooring:
Rat guard and fire must be rigged in place.
Anchor must be brought home if back out during standby for letting go.
Mooring equipment should be secured in place.

After undocking:
Inspections of pilot ladder or accommodation ladder before permitting the pilot use it disembarked.
Ensure that life ring with lights (illumination tested and working) and 30 meters line attached to it is ready for use.
Inspections of mooring lines and other mooring equipments for possible damage during port stay and repair to be carried out before securing.
Lashed and secured anchor and cement box spurling tube to avoid sea water ingress to chain locker room.
Secured mooring lines stored on deck to avoid washed out during heavy weather.

4.3.8 Emergency Towing Wires

The officer of the watch shall ensure that the emergency towing-off wires, positioned fore and aft are handed out and ready for use without adjustment should the ship need to be towed away in case of fire or other emergency. Unless otherwise required by port regulations, the eye of the towing wire shall be not more than 1 meter above the waterline, but shall not be submerged. Sufficient slack shall be run out on deck to allow a tug to efficiently tow the vessel. To prevent slack from running out it should be secured by a rope or other means, that break away easily due to the towing force of the tug. The slack of the fire shall be so positioned to prevent injury to personnel working in the mooring area during normal operations. The end shall be either fastened by means of an eye or properly up in the bits.

A common method is to provide two wires, one near the bow and one near the stern. They are secured to bollards with a minimum of five turns and are led directly to a shipside chock with no slack on deck. The outboard end of the line is provided with an eye to which a heaving line is attached and led back the deck; During loading or discharge, the heaving line is periodically adjusted to maintain the eye of the fire wire one to two meters above the water as shown in figure. Some terminals require different methods and operators should be aware of local regulations. When not in use, the wires are preferably spooled onto reels which may be located on or below deck.
4.3.9 Hawser Condition

Mooring lines should be retired when strands are damaged or cut. Attention shall be paid to any signs of abrasion burning. The eye of the rope shall be closely inspected since this is an area where high abrasion exists. Hawses shall be inspected for any hocks. Hocks reduce the strenght of the rope and they normally appear where the rope was twisted when used. Proper coiling and uncoiling of mooring ropes is important to prevent these kind of damages. Rope on winch drums shall be turned end to end at least every 6 MONTHS to avoid twisting.

If the hawser shows signs of fiber deterioration due to sunlight or age it should be replaced. (apply Moorings ropes end to end program)

For the rope care duty persons must be consider items below
* Ropes must be kept clear of chemicals, chemicals vapors or other harmful substances. They should not be stored near paint or where they may be exposed to paint or thinner vapors.
* Ropes should not be exposed to sun longer than is necessary, as ultra violet light can cause fibres to deteriorate.
* Ropes must be visually inspected at regular intervals, and these inspections should include, so far as possible, inspection of the inner strands. The inspection should include checking for security of strands in splices.
* Ropes must be stowed in a well ventilated compartment on wood gratings to allow maximum air circulation and to encourage drainage.
* Do not store ropes in the vicinity of boilers or heaters; do not store them against bulkheads or on decks which may reach high temperatures.
* Ensure that fairleads and warping drums are in good condition and free from rust and paint. Roller heads should be lubricated and freely moving to avoid friction damage to the rope.
* Do not surge ropes around drum end or bitts, as the friction temperature generated may be high enough to melt the fibres.
* Do not drag ropes along the deck; if this is unavoidable, ensure that they pass clear of sharp edges or rough surfaces.
* When using winch stored ropes, do not run them trough leads which are not a direct line from the drum, as they are liable to chafe on the edge of the spool.

4.3.10 If Anchor Is Used

Effective look out shall be implemented. Precautions shall be taken against twisting of chain, excessive swinging of the bow and dragging of anchor. The chains shall not remain on heaving up position. They shall be secured well. Chain locks shall be used.

4.3.11 Winch Break Test

Each winch break is to be tested individually and tests are to be carried out prior to the vessel’s delivery and every year thereafter in line with recommendations in the ISGOTT chapter 3. In addition, individual winches are to be tested after completion of any modification or repair involving the winch breaks or upon any evidence of premature brake spillage or related malfunctions.

For each vessel a winch test specification is prepared incorporating specific instructions for setting up the test gear, preparation of the winch for testing, setting of the winch brakes, application of the test load, revision of torque wrench or hydraulic pressure readings if required, and recording of test results. The coefficient of friction of the brake lining is considerably affected by moisture. To assure constant results the winch is to be operated for a short period with the brake set slightly on to dry the brake surface.

All winch testing is to be carried out under the supervision or in the presence of a senior officer designated by the master or chief engineer or repair superintendent familiar with the test procedure and the operation of the winches.

Typical equipment for testing the brakes includes the following items:
* Lever consisting usually of two pieces of bar as shown on the sketch. The lever is secured to the drum of the winch by means of bolts furnished with the test kit and fitted through holes provided in the drum flange;
* Hydraulic jack with pressure gauge; and
* Foundation to be placed under the hydraulic jack for the purpose of distributing the load into the deck structure.

The testing arms are bolted to the flange of the winch drum with the hydraulic jack pressed under the end of the arms at the designated location and resting on supports. The flange brake is set as recommended in the test specification. If the winches are set normally, a torque wrench should be used. If they are set hydraulically. The pressure gauge should first be calibrated.
Before testing, the detailed instruction for testing included in the test specification should be reviewed and the equipment prepared accordingly. The instruction will include:

- The values for torque wrench or pressure gauge fitted for setting up the brakes.
- A curve or table relating hydraulic jack test pressure to line pull; and
- hydraulic jack pressure at the which the brake is designated to render.

With the winch prepared for testing, the testing gear securely in place and winch brakes set in accordance with the recommendations, pressure is applied to the hydraulic jack. The winch drum is to be carefully observed. At the first sign of movement, the hydraulic pressure applied to the jack is recorded and the following action taken:
- If slippage occurs at a pressure less than designed, the brake should be tightened or repaired and jack pressure reapplied;
- If the recorded pressure corresponds to the design pressure the jack should be released and the test gear removed; or
- If spillage does not occur at the design pressure, the brake setting should be adjusted so the brake can render at the design load.

The lever should be lightweight for easy handling. Testing can be further simplified by reducing the lever to slightly more than the drum flange radius and placing the jack directly on the winch foundation.

Once the brakes are tested and calibrated, the proper setting should be recorded. In case of conventional screw brakes, a tag should be attached stating the proper torque. For spring-applied brakes, the spring compression distance should be recorded and the spring adjustment mechanism secured with a seal.

The primary brake should be set to hold 60% of the mooring line’s MBL. Since brakes may deteriorate in service, it is recommended that new equipment be designed to hold 80% of the line’s MBL, but have the capacity to be adjusted down to 60% of the line’s MBL.
CHAPTER 5

CARGO HANDLING

Chemical tankers have a risk which may occur during the loading, voyage and unloading. Care should be paid to minimize this risk as far as practicable in each cargo handling case, based upon the best knowledge and technology on the construction and equipment of the ship and the properties of the cargoes intended to carry.

To this end and the captain and/or responsible officers should well know about the precautions described in Chapter 2, 3 and 4 of this manual, and prior information and arrangement should be exchanged between the ship and terminal as described in 5.1 of this Chapter.

Further, the precautions described in 5.2 and thereafter should be well known to persons involved for ensuring safety.

5.1 EXCHANGE OF INFORMATION AND PRIOR ARRANGEMENT

5.1.1 Exchange of information before berthing

When a radio link is available to provide communication between the ship and terminal before she arrives at a berth or mooring, in addition to any advice on cargo to be loaded or discharged, it is recommended that prior information should be exchanged on items which could affect the safety of the ship or terminals, such as;

1. The ship to terminal
   (i) the ship’s draft and trim at arrival
   (ii) advice stowage factor.
   (iii) any hull, bulkhead, valve or pipeline leaks on the ship which could affect loading or unloading, or cause pollution
   (iv) necessary repair which would cause the commencement of loading or unloading to be late
   (v) the standards of size and bolt hole on the flanges at the manifold connections
   (vi) the standards of size and bolt hole on the flanges at the vapour return line

2. Terminal to the ship
   (i) availability of tug and mooring craft, when necessary, which will assist in manoeuvring and mooring
   (ii) mooring lines and accessories which the ship is required to have available for initial mooring operation
   (iii) any particular feature of a jetty berth or buoy mooring which it is considered desirable to give the prior notice to the captain
   (iv) for jetty berths, arrangements of gangway landing space or availability of terminal access equipment
   (v) for buoy moorings, details of any mooring plan and of any code of visual or audible signals for use during mooring
   (vi) for buoy moorings, lifting capacity of the ship’s derrick required for handling hoses
   (vii) depth of water at berth
   (viii) weather information

3. SHIP-TO-SHIP TRANSFER OPERATION

The above cargo discharging procedure should be followed, the Ship To Ship Transfer Guide (ICS) should be referred and GF-6.01 D should be filled for the Ship-to-Ship transfer operation.

CLOSED LOADING

For effective closed loading, cargo must be loaded with the ullage, sounding and sighting ports securely closed. The gas displaced by the incoming cargo must be vented to the atmosphere via the mast riser(s) or through high velocity or constant velocity valves, either of which will ensure that the gases are taken clear of the cargo deck. Devices fitted to mast risers or vent stacks to prevent the passage of flame must be regularly checked to confirm they are clean, in good condition and correctly installed.

CLOSED SAMPLING/GAUGING

It is necessary to prevent or minimize the release of vapour from the cargo tank headspace during measurement and sampling operations. Wherever possible, this should be achieved by use of closed gauging and sampling equipment. Equipment required
for the measurement of ullage and temperature within cargo tanks may be either fixed (permanently installed) or portable and samples will normally be drawn using portable equipment. Closed gauging or sampling will be undertaken using the fixed gauging system or by using portable equipment passed through a vapour lock. Such equipment will enable ullages, temperatures; water cuts and interface measurements to be obtained with a minimum of cargo vapours being released.

When it is not possible to undertake closed gauging and / or sampling operations, open gauging will need to be employed. This will involve the use of equipment passed into the tank via an ullage or sampling port or a sounding pipe and personnel may therefore be exposed to greater concentrations of cargo vapour. A cargo compartments may be in a pressurized condition, the opening of vapour lock valves, ullage ports or covers and authorized personnel should undertake the controlled release of any pressure only. When measuring or sampling, care must be taken to avoid inhaling gas. Personnel should therefore keep their heads well away from the issuing gas and stand at right angles to the direction of the wind. Standing immediately upwind of the ullage port might create a back eddy of vapour towards the operator. In addition depending on the nature of the cargo being handled, consideration may have to be given the use of appropriate respiratory protective equipment.

The gauging of tanks should be effected by use of a closed gauging system or via vapour locks. For the ullaging system to be acceptable for this purpose, the gauging system is described in the vessel’s tank calibration documentation. Temperatures can be taken using electronic thermometers deployed into the tank through vapour locks. Such instruments should have the appropriate approval certificates and should also be calibrated. Samples should be obtained by the use of special sampling devices using the vapour locks.

5.1.2 Advice to terminal from the ship before loading / unloading

The responsible officer of the ship should inform terminal officer of the following information.

1. Information on the ship
   (i) general arrangement of cargo, ballast and bunker tank
   (ii) ship’s draught and trim at arrival
   (iii) ship’s manifold detail, and standards of size and bolt hole on the flanges
   (iv) arrangement of cargo vapour return lines and flange size
   (v) any hull, bulkhead, valve or pipeline leaks which could affect loading or unloading, or cause pollution
   (vi) any necessary repairs to be under taken which could delay the commencement of loading / unloading
   (vii) maximum draft upon completion of loading

2. Cargo, bunker and ballast details before loading.
   (i) cargo quantities acceptable from terminal nominations
   (ii) details of last cargo carried, method of tank cleaning (if any) , and state of cargo tanks and state of cargo tanks cargo pipelines.
   (iii) quantity and disposition of slops.
   (iv) disposition, composition and quantities of ballast and time required for discharge.
   (v) quantities of fuel and drinking water to be required

3. Loading plan of the ship
   (i) Loading arrangement and procedures
   (ii) proposed method of venting from the cargo tanks

4. Cargo details before unloading
   (i) Kinds and properties of cargoes
   (ii) special precautions for unloading cargoes
   (iii) cargo quantities and loading conditions
   (iv) ullage after the ship entered into the cargo loaded voyage. If any change of the temperature difference is found, sufficient care should be paid to leakage of the cargo into the spaces adjacent to the cargo tanks.
(v) cargo temperature at arrival

5. Unloading procedures of the ship

(i) unloading procedures
(ii) maximum unloading capacity and pressure of the cargo pumps, and unloading rate and pressure

5.1.3 Advice to the ship from loading/unloading terminal

The responsible officer should be informed of the following from terminal.

1. Cargo and bunker detail before loading

(i) Kinds and properties of cargoes
(ii) Special precautions of cargo handling
(iii) Quantities of loading cargoes
(iv) Bunker details
(v) Loading temperature
(vi) When necessary, certificates and data for inhibitors, etc. added to cargoes (see item 5.8)

2. Loading plan

(i) Loading procedures
(ii) Maximum transferring rate of terminal for acid cargo
(iii) Number and sizes of cargo hoses or loading arms which can be available
(iv) Moving range of cargo hoses or loading arms
(v) Maximum pressure of the ship/terminal connections
(vi) Loading rate of bunker
(vii) Communication/signal system for loading controls including emergency stop.

3. Unloading plan

(i) Cargo receiving procedures of terminal
(ii) Maximum receiving rate for each cargo
(iii) Maximum pressure at the ship/terminal connection
(iv) Any other limitations at the terminal

5.1.4 Agreed cargo handling

On arrival to the load berth;
- Meet with the loading master and surveyors and other Terminal representatives coming on board.
- Have Ship/Shore agreement signed and ensure that ship or shore stop of loading is determined and also make sure that related ship staff are informed of the terms of the agreement.
- Carry out the Terminal requests if there is any further to the Ship’s arrangements.
- Accompany the surveyor in cargo tanks inspection. Use plastic shoes covers during inspections for protecting the tanks cleanliness.
- Hose connection and disconnection responsibility lies with the terminal staff unless contrarily agreed, therefore assists only if requested, in order not to take an undesired responsibility.
- Deliver a copy of the Loading Plan and the Tentative Stowage Plan to the Loading Master, as well.

**DO NOT COMMENCE LOADING UNLESS YOU HAVE THE MSDS (MARITIME SAFETY DATA SHEET) OF THE CARGO (ES) TO BE LOADED.**
- Seek for advice/information from the Loading Master or cargo representatives for loading, carriage conditions such as heating requirement or adding inhibitor, discharging, cleaning and the hazard data of the cargo, to support or upgrade your information. If possible, try to get it in writing.
5.1.4.1 Agreed cargo loading

In order to secure the safety of the cargo loading, a loading plan should be agreed by the responsible ship’s officer and terminal representative on the basis of the information exchanged between the ship terminal having regard to the items 5.1.1 to 5.1.3 and the following conditions:

(i) The kinds and properties of the cargoes to be loaded.
(ii) The arrangement and capacity of the ship’s cargo line and venting system and shore’s cargo line.
(iii) The maximum allowable pressure of the ship/shore hoses or loading arms to be used.

5.1.4.2 Agreed loading plan

In order to secure the safety of cargo loading, an loading plan should be agreed by the responsible ship’s officer and terminal representative on the basis of the information:

(i) Loading rate and pressure
(ii) Loading procedures
(iii) Necessary precautions to avoid static ignitions
(iv) Atmospheric conditions
(v) System of ullaging
(vi) System of cargo vapour return to shore installation
(vii) Overflow control
(viii) Movement or operation which may change flow rate
(ix) The kinds and numbers of safety equipment to be used
(x) Numbers of cargo operators

5.1.4.3 Agreed unloading plan

In order to secure the safety of cargo unloading, an unloading plan should be agreed by the responsible ship’s officer and terminal representative on basis of the information exchanged between the ship and terminal having regard to the items 5.1.1 to 5.13 and the following conditions:

(i) The kinds and properties of the cargoes to be unloaded.
(ii) The arrangement and capacity of the ship’s cargo line and venting system and shore’s cargo line.
(iii) The maximum of discharge capacity and pressure of that cargo pump to be used, and discharge rate and pressure.
(iv) The maximum allowable pressure of the ship/shore hoses or loading arms to be used.
(v) Unloading procedures.
(vi) Necessary precautions to avoid static ignitions.
(vii) Movement or operations which may change flow rate.
(viii) The kinds and numbers of safety equipment to be used.
(ix) Numbers of cargo operators.

5.1.4.4 Signal system for loading and unloading control

Before loading or unloading commences, a signal system for control during cargo handling should be established and agreed, indicating:

(i) “Standby”
(ii) “Start loading” or “start unloading”
(iii) “Slow down”
(iv) “Stop loading” or “stop unloading”
(v) “Emergency stop”

and any other necessary signals should be agreed and established. The signal system to be used should be clearly specified and understood by the ship and shore personnel on watch and on duty during cargo handling operations, but if there are any doubts on oral understanding, the ship and shore connections should be clearly marked for signal identification.
At each change of watch or shift, the responsible ship’s officer terminal representative should confirm with each other that the signal system is understood by them and by the personnel on watch/ duty at the ship to shore connection.

5.1.5 Agreed safety precautions and emergency procedures

(See Chapter 6. for detail)

5.1.5.1. Terminal Safety Regulations

After berthing the responsible ship’s officer should contact the terminal representative to

(i) provide the information on local safety regulations,
(ii) agree designated smoking spaces,
(iii) agree galley fire and cooking appliance limitations,
(iv) advise “Work permit” and “Hot Work Permit” procedures and
(v) present and discuss Ship/Shore Safety Check List.

5.1.5.2. Tanker and terminal fire fighting equipment and procedures.

On the tanker’s arrival, the appropriate ship’s officer and the responsible terminal representative should discuss the action to be taken in the event of emergency or a fire. This should include means of communication and emergency capability. Preferably, a notice “Instruction in Case of Fire” should be issued.

5.2 GENERAL PRECAUTIONS

The captain is responsible for ensuring that all on board should observe the following precautions;

5.2.1. Notices

On arrival at a terminal, a ship should display notices at conspicuous places in appropriate wording;

NO SMOKING
NO USE OPEN LIGHT
OFF LIMITS

5.2.2. Access to the ship

The means of access should be so placed as to be convenient for supervision and be well and safely during illuminated darkness.

5.2.3. Unauthorized persons

Persons who have no legitimate business on board, or who do not possess the captain’s permission, should be refused access to the ship. Authorized but apparently intoxicated persons should not be allowed on board unless special precautions for their reception on board have been made.

5.2.4. Smoking

*The captain should specify the smoking spaces and strictly prohibits smoking without the restricted area and keep closed all openings / windows / doors of these areas*

5.2.5. Matches and lighters

Matches and lighters, for personal use, should not be carried by personnel at work in dangerous spaces.
5.2.6. Use of tools

Prior to use of tools, it should be ascertained that no gas exist in the vicinity. Tools should be used for own use.

5.2.7. Other equipment

(a) The use of galley stoves and other cooking appliances should be permitted that the captain and terminal representative jointly agree that no hazard exists.

(b) No portable lamps and electric equipment on flexible cables should be used in dangerous spaces. Only explosion-proof type portable lamps (approved type) can be used.

5.2.8. Use of portable electrical equipment in hazardous areas

Portable electric lamps and portable electric equipment for use in hazardous areas must be of an approved type. Special care should be taken to prevent any mechanical damage to flexible cables or wandering leads.

Any other electrical or electronic equipment of non-approved type, whether mains or battery powered, must not be active, switched on or used within hazardous areas. This includes radios, mobile telephones, radio pagers, calculators, photographic equipment and any other portable equipment that is electrically powered but not approved for operation hazardous areas. It should be borne in mind that equipment such as mobile telephones and radio pagers, if switched on, can be activated remotely and a hazard can be generated by the alerting or calling mechanism and, in the case of telephones, by the natural response to the call.

In view of the ready availability and widespread use of such equipment, appropriate measures should be taken to prevent its use within hazardous areas. Personnel must be advised of the prohibition of non-approved equipment and terminals should have a policy for informing visitors of the potential dangers associated with the use of electrical equipment. Terminals should also reserve the right to require any non-approved items of equipment to be deposited at the entrance to the port area or other appropriate boundary within the terminal.

Items such as mobile telephones and radio pagers should only be re-commisioned once they are in a safe area, such as within the ship’s accommodation.

5.2.9. Communication equipment

(a) Portable communication equipment used on board should be approved type recognized authority.

(b) Transmitting aerials should be kept in “OFF”.

5.2.10. Protective equipment

It should be inspected that all protective equipment are in good order.

5.2.11. Tank entry prior to entry

When cargo tanks to be loaded are needed to be inspected, sufficient caution should be paid for the following conditions. (see also 7.3)

(a) At first, gas detection should be carried out.
Personnel should not enter cargo tanks unless the responsible ship’s officer has confirmed that the cargo tank is free of toxic vapour and not deficient in oxygen.

(b) When it is unavoidable to enter the cargo tanks not toxic gas free, only personnel wearing breathing apparatus and other necessary protective equipment can enter the spaces. All protective equipment should be toughly cleaned the work.

(c) Tank entry should be under the permission and close supervision of a responsible ship’s officer.

(d) In any case, only explosion-proof type portable light can be used.
5.3 PREPARATIONS BEFORE LOADING / UNLOADING

The responsible ship’s officer should ensure that all on board should observe the following conditions prior to cargo handling.

5.3.1 Closing the openings in superstructures

1. *Before commencement of and during the cargo handling of inflammable and/or toxic cargoes, gas freeing and tank cleaning, the doors, windows and other openings in accommodation spaces and engine room should be closed.*

2. *Selected doors may be opened momentarily to permit access but should be closed immediately afterwards. Doors required to be kept closed should be clearly marked but in no case should doors be locked.*

5.3.2 Trimming of ventilators

1. Before commencement of and during the cargo handling, ventilators should be trimmed and kept trimmed to prevent the entry of dangerous gases.
2. Mechanical ventilation systems serving cargo pump rooms should be in use of cargo pump rooms.
3. Air conditioning unit in accommodation spaces should be stopped because of the dangerous gas entering into the accommodation spaces.

5.3.3 Openings in cargo tanks

1. Opening in cargo tanks should be opened only one necessary in gas-freeing, tank cleaning, tank inspection, measuring and gas detecting.
2. During tank cleaning or gas freeing operation, only those tank washing covers in the tanks in question should be removed.

5.3.4 Cargo pump room

1. Personnel should not enter the cargo pump room without the permission of the responsible officer.
2. The breathing apparatus should be in an easily accessible position.
3. Life line and save equipment in pump room should be ready for immediate use.

5.3.5 Piping

1. Scupper plugs
   Before cargo handling commences, all deck scuppers should be effectively plugged to prevent spilled oil escaping overboard. Accumulations of water should be drained off periodically and scupper plugs replaced immediately after the water has run off.
2. Cargo piping not in use
   All cargo piping when not in use should be secublinked at the manifold.
3. Sea Valve
   Connecting sea valve to the cargo lines should be exactly closed and locked.

5.3.6 Cargo hose - Inspection and Handling (FLEXIBLE HOSES)

All Cargo hoses must be inspected before use by visually.

1. Before connecting up, hose strings should be examined for any possible defect which may be visible in the bore or outer covers such as blistering, abrasion, or evidence of leakage. When the cargo hoses of the shore installation are used and any defects are found in the cargo hoses, the captain should refuse the use of the defective cargo hoses.
2. Cargo hoses should always be handled with care and should not be dragged over a surface bended excessively or rolled in a manner which would twist the body of the hose. Protection should be provided at any point where chafing or rubbing can occur. Hose should not be allowed to come in contact with a hot surface such as a steam pipe.

3. As the ship rises or falls on account of tide or cargo operations, the hose strings should be adjusted to avoid excessive strain on the hose and connections.

4. Hoses should have blank flange fitted immediately after they are disconnected from the ship’s manifold.

5.3.7 Earthing

1. All metal on the shore side of an insulating flange or a single length of non-conducting hose should be electrically continuous to the jetty earthing system and all metal to the seaward side should be electrically continuous to the ship.

2. The cable should be connected before loading or unloading commences and should not be disconnected until loading or unloading is completed and cargo hose is disconnected.

5.3.8 Check of heating coil

Heating coils for cargo heating should be inspected before the commencement of use to ensure that there is no defect such as leakage. Further caution should be paid for the following special equipment provided by the IMO Chemical Code.

1. As for the heating coil in cargo tanks that may contain toxic products, the coil return should be tested not only at the commencement of heating of a toxic product, but also on the first occasion the coil is used subsequent to having carried an heated toxic cargo. In this precaution, “Toxic product” means a product designated as “T” in “H” column of the minimum requirements of the IMO Chemical Code as well as a product complied with the requirement of 4.9 of the Code.

Example of Loading History and Checking.

- Loading a toxic product with heating
- Loading a toxic product without heating
- Loading a non-toxic product without heating
- Loading a non-toxic product with heating

2. Loading condition without heating

Compressed air should be fitted into the heating coils in the cargo tank internal pressure higher than the cargo tank internal pressure (1.5 kg/cm² or over) via the connecting hoses between the hoses valves of the heating coils. During the filling compressed air, it’s filling pressure should be arbitrarily checked for preventing to reduce the pressure.
5.3.9 Safety check list

Prior to the commencement of the cargo handling, the responsible officer of the ship and the responsible terminal representative should at least check the following 37 items for the purpose to confirm whether necessary controls and safety measures have been carried out or not, and also should frequently check them during the entire period of the operations:

1. Appropriate the ship and shore personnel have been notified that the cargo handling is about the begin.
2. Warning notices are displayed on ship and shore as required.
3. No authorized persons are on board the ship.
4. No authorized drafts are alongside.
5. Any authorized draft alongside is advised that cargo/ballast handling operations are about to begin and that necessary safety measures are to be observed.
6. No authorized work is being carried out.
7. Canvas covers are removed from the ship’s fooldlights.
8. All cargo and other lines required for use are properly set.
9. Are galley requirements being observed?
10. Are smoking regulations being observed?
11. Are naked light requirements being observed?
12. Are electric cables to portable equipment disconnected from power?
13. Are the ship’s main transmitting aerials switched “OFF”?
14. Are hand torches of approved type?
15. Are portable R/T sets of approved design?
16. Are all doors and ports that are required to be closed in fact closed?
17. Are cargo pump room ventilators in sufficient condition?
18. Are ventilators suitably trimmed with regard to prevailing wind conditions?
19. Are air conditioners stopped?
20. Is the ship securely moored?
21. Are cargo/bunker hoses in good condition?
22. Are cargo/bunker hoses properly rigged?
23. Are cargo vapour return lines properly arranged, if necessary?
24. Are overflow lines properly arranged?
25. Are unused cargo/bunker connections?
26. Are unused cargo vapour returns taken off the short pieces between the return lines and the cargo vent lines, and blanked?
27. Are scuppers effectively plugged?
28. Where it is necessary to segregate a cargo from other cargoes, are the short pieces taken off and blanked?
29. Is no failure of heating coil ensured by checking steam drain pipes?
30. Is the agreed ship/shore communication system able to use?
31. Are all cargo/bunker tank kids closed?
32. Are all cargo tanks being loaded and unloaded open to atmosphere via the agreed venting system?
33. Are fire hoses and equipment ready for use?
34. Are emergency towing wires correctly positioned?
35. Is the ship ready to move under its own power?
36. Where a cargo handling in which toxic gas can not be detected, are all persons concerned protected by safety equipment?
37. Are earthing/bonding in good condition?
38. Are all cargo tank hatch closed?

5.4 GENERAL CARGO HANDLING DURING LOADING / UNLOADING

The safeguards mentioned in this section should be maintained through the period of loading unloading cargoes:

5.4.1 Supervision and control of loading and unloading

1. A responsible ship’s officer should be on watch and adequate crew strength should remain on board to deal with the operation and security of the ship. A member of the ship’s crew should be on watch on the deck.
2. The agreed ship/shore communication system should be maintained in good working order.
3. At the commencement of loading or unloading and each change of watch or shift, the responsible ship’s officer and the
responsible terminal representative should confirm with each other that signal system for loading and unloading control is understood by them and by personnel on watch/duty.

5.4.2 Checks during cargo handling
At the commencement of and during loading,, regularly checks should be made by the responsible ship’s officer to see the following items as well as the items shown in the check list of this manual.
1. Cargo is entering the designated cargo tanks only.
2. There is no escape of cargoes into the pump room, cofferdams, etc.
3. There is no escape of cargoes through the scupper plugs and the overboard discharge valves
4. Pressure of the pipe lines and hoses/arms, and the estimated quantity of cargoes loaded or unloaded. Any drop in pressures or any marked discrepancy between the ship and shore estimate of quantities could indicate pipe line or hose leakage and require interruption of cargo operations until investigated.

- Keep a watchman on deck continuously, properly dressed and equipped with a portable radio who will check carefully for any leakage, malfunction of pumps or any abnormal situation and report to the duty officer.
- Get ullage figures and temperatures every hour and record them as in the GF-6.01 B or in the event that vessel is fitted with CARGO MONITORING SYSTEM computer, get a printout of same and attached to GF-6.01 B
- Keep back pressure records in minimum hourly intervals. (GF-6.03 A Cargo Manifold Back Pressure Checklist)
- While discharging last tank(s), remember to check other tanks supposed to be empty for a probable leakage that might have occurred due to a valve deficiency or simple forgetting.
- Notify the terminal 1-hour before and 10 minutes before completion.
- The Chief Officer / Cargo Officer shall attend personally the cargo operation during all critical steps.

At approaches to discharging port, following actions are to be started, provided that the vessel is berthing directly.
- Prepare a discharging plan as in the GF-6.01 A and deliver the copies to the junior deck officers and the bosun/pump man with their counter signature on your copy which has to be kept in ship’s file.
- The cargo valves, lines, manifold and pump settings will be done by the pump man for the intended discharging plan, and the settings must be cross checked by the Chief Officer / Cargo Officer on duty.
- Get scuppers plugged in.
- Ensure that all flanges are fully bolted without missing bolts.
- Get main deck clean and safe, wiping away any oil on deck or any obstacles that may prevent safe action on deck.
- The closed discharging / closed sampling procedure placed on the last page of the procedure GP-6.01 will be followed for all cargoes discharged.

On arrival to the discharging berth;
- Meet with the terminal representatives and surveyors coming on board.
- Have Ship/Shore agreement signed and make sure that related ship staff is informed of the terms of the agreement.
- Carry out the Terminal requests if there is any further to the Ship’s arrangements.
- Accompany the surveyor for taking the cargo ullages and temperature readings.
- Hose connection and disconnection responsibility lies with the terminal staff unless contrarily agreed, therefore, assist only if requested, in order not to take an undesired responsibility.
- Deliver a copy of the Discharging Plan to the Terminal Representative, as well.
- Await for cargo analysis results and confirmation for discharging from shore side.
- Monitor regularly the atmosphere by using the relevant measurement meters and record the readings in GF-6.03 C. (O2/Expl./Drager)

During discharging;
- Keep a watchman on deck continuously, properly dressed and equipped with a portable radio who will check carefully for any leakage, malfunction of pumps or any abnormal situation and report to the duty officer.
- Get ullage figures and temperatures every hour and record them as in the GF-6.01 B or in the event that vessel is fitted with CARGO MONITORING SYSTEM computer, get a printout of same and attached to GF-6.01 B
- Keep back pressure records in minimum hourly intervals. (GF-6.03 A Cargo Manifold Back Pressure Checklist)
- While discharging last tank(s), remember to check other tanks supposed to be empty for a probable leakage that might have occurred due to a valve deficiency or simple forgetting.
- Notify the terminal 1-hour before and 10 minutes before completion.
- The Chief Officer / Cargo Officer shall attend personally the cargo operation during all critical steps.

Upon completion of discharging;
- Stop cargo pumps.
- Ask the terminal operator to notify the surveyors, terminal representatives.
- Blow the lines with air to sweep out the cargo to shore (if agreed and confirmed by the terminal).
- Notify engine department that discharging is over.
- Ensure that the surveyors issue “Dry Tank Certificate or Empty Tank Certificate” to vessel.
- Hose is disconnected.
- Ensure that times of all events of the discharging operation are recorded in the Cargo logbook and main points are transferred in the Deck logbook.
- Ensure that the Cargo Record Book is entered in accurately.
- Prepare a copy of full cargo documents to deliver/expedite to the Company, retaining a full set in Ship’s file.
- **Check the performance of each cargo pump individually every month by filling the GF-6.03 D Cargo Pumps Performance Checklist and send a copy to the Company within monthly intervals.**
  (Use only one by one pump during the check of the performance – do not use pumps simultaneously during the performance check)

For proper functioning of this procedure, the Discharging Checklist (GF-6.03 B) is recorded and retained in ship’s file.

### 5.4.3 Ullaging and sampling

Depending on the toxicity and/or volatility of the cargo, it may be necessary to prevent or minimise the release of vapour from the cargo tank headspace during measurement and sampling operations. Wherever possible, this should be achieved by use of closed gauging and sampling equipment. Equipment required for the measurement of ullage and temperature within cargo tanks may be either fixed (permanently installed) or portable and samples will normally be drawn using portable equipment. Closed gauging or sampling will be undertaken using the fixed gauging system or by using portable equipment passed through a vapour lock. Such equipment will be enable ullages, temperatures, water cuts and interface measurements to be obtained with a minimum of cargo vapours being released. This portable equipment, passed through vapour locks, is sometimes referred to as ‘restricted gauging equipment’.

When it is not possible to undertake closed gauging and/or sampling operations, open gauging will need to be employed. This will involve the use of equipment passed into the tank via an ullage or sampling port or a sounding pipe and personnel may therefore be exposed to greater concentrations of cargo vapour.

1. Ullaging in usual manner should be carried out by Hermetics.
2. Sampling by using cargo hatches or sounding pipes should be carried out in accordance with the following precautions:
   
   (i) To wear protective helmet, goggle, overall, gloves, high boots and gas mask.
   (ii) Not to be used a rod or tape consisted of a synthetic fibre.
   (iii) Personnel should stand facing at right angle to the wind direction.
   (iv) To be free from pressures in the cargo tanks, prior to sampling.
   (v) To avoid the risk of sparks in flammable atmospheres, when the cargoes may be charged with static electricity, where the use of manual metal tapes or sounding rods.

During loading, and for 30 minutes after the completion of loading, metallic equipment for dipping, ullaging or sampling must not be introduced into or remain in the tank. Examples of equipment include manual steel ullage tapes, portable gauging devices mounted on deck standpipes, metal sampling apparatus and metal sounding rods. Non-conducting equipment with no metal parts may, in general, be used at any time. However, ropes or tapes used for lowering equipment into tanks must not be made from synthetic materials. After the 30 minutes waiting period, metallic equipment may also be used for dipping, ullaging and sampling but it is essential that it is effectively bonded and securely earthed to the structure of the ship before it is introduced into the tank and that it remains earthed until after it has been removed.

(vi) The sampling should be carried out on the designated hatches, and when the completion of the hatch covers should be immediately closed.

### 5.4.4 Cargo spillage and leakage

At the commencement of cargo handling operations and at regular intervals throughout loading and unloading, both ship and shore personnel should maintain a close check against the escape of the cargo. Should leakage occur from a pipe line, valve, hose or metal arm, operations through that connection should be stopped until the cause is ascertained and the defect is remedied. Should a burst occur in a pipe line, hose or metal arm, or if an overflow occurs, all cargo and bunker operations should be stopped immediately and a state of emergency declared should remain in force until it is
considered that all danger of fire or explosion is passed. When loading / unloading of acids, the connections of ship / shore should be protected by the covers of non-corrosive to acids.

5.4.5 Gas detection

During the cargo handling of products having properties of flashpoint between 61°C and/or toxic products designated as ”T” in the IMO Chemical Code (see 2.2 of this manual), gas detecting should be regularly carried out for the machinery, accommodation spaces, etc.

5.4.6 Climatic conditions while loading / unloading

Loading or unloading of volatile petroleum, etc. should be stopped during nearby severe electrical storms. During periods of no wind or little wind when flammable vapours can not be dispersed quickly through to prevent possible hazard from accumulated gas pockets, the loading of volatile petroleum should be stopped or the loading rate adjusted at the discretion of the responsible ship’s officer or the terminal representative.

5.4.7 Control of pumping

To avoid the problems and hazard arising from excessive pressure, particularly surge pressure, throughout pumping operations there should be no abrupt changes in the rate of flow.

1. Loading
   (i) The responsible ship’s officer should request loading to commence at a slow rate.
   (ii) Shore pumps should be adjusted to minimize pulsation in the hose stringers or metal arms.
   (iii) The valves of the ship’s manifolds and filling openings should be fully opened and the others hold be closed before the operation of shore pumps.

2. Unloading
   (i) The terminal representative may request unloading to commence at a slow rate.
   (ii) Shore valves should be fully open to receiving tanks before the ship’s manifold valves are opened.

5.4.8 Valve operation

When change over of tanks on the ship or shore in to be made with flow of cargo and pressure maintained in the pipe line system, valves to the tanks about to receive cargo should be opened before closing the valves of tanks which have been receiving cargo. Alternatively, when the changeover is to be made the pressure should be shut off.

5.5. GENERAL OPERATIONS AFTER COMPLETION OF LOADING / UNLOADING

5.5.1 Topping off and cessation of loading

1. Loading
   (i) When topping off into final tank the terminal should be requested to reduce the loading rate sufficiently to permit effective control of the flow.
   (ii) During loading the flow should be controlled by the use of shore valve or shore pumps.
   (iii) The necessary operations of ship’s valves should be done with the greatest care to avoid shutting off against the shore and subjecting the pipelines and ship / shore connections to excessive pressure from surge.

2. Cessation of loading
   (i) When the shore is required to stop loading, a responsible ship’s officer should give the pre-arranged signal to the terminal operator in ample time.
(ii) The shore control valves should be closed before the ship’s valves are closed.

(iii) In an emergency, if the shore valves cannot stop the flow in reasonable time it may be necessary to close the ship’s valves to prevent overflow.

5.5.2 Confirmation of loaded quantity

1. After the completion of the cargo loading, the loaded quantity of the cargo tanks should be ensured by the responsible officer of the ship and the responsible representative of the shore.

Upon completion of discharging:

- Stop cargo pumps.
- Ask the terminal operator to notify the surveyors, terminal representatives
- Blow the lines with air to sweep out the cargo to shore (if agreed and confirmed by the terminal)
- Notify engine department that discharging is over.
- Ensure that the surveyors issue “Dry Tank Certificate or Empty Tank Certificate” to vessel.
- Hose is disconnected.
- Ensure that times of all events of the discharging operation are recorded in the Cargo logbook and main points are transferred in the Deck logbook.
- Ensure that the Cargo Record Book is entered in accurately.
- Prepare a copy of full cargo documents to deliver/expedite to the Company, retaining a full set in Ship’s file.
- Check the performance of each cargo pump individually every month by filling the GF-6.03 D Cargo Pumps Performance Checklist and send a copy to the Company within monthly intervals. (Use only one by one pump during the check of the performance – do not use pumps simultaneously during the performance check)

For proper functioning of this procedure, the Discharging Checklist (GF-6.03 B) is recorded and retained in ship’s file.

5.5.3 Taking off cargo hoses and closing of pipes

1. After the completion of the cargo loading / unloading, all cargo valves involved should be closed.
2. After the check of the valves closing, cargo hoses should be taken off.
3. Leaked cargoes at taking off the cargo hoses should be collected into the cargo pans.
4. The breather valves should be checked that they are correctly set.
5. Change the fitted position of the flange for preventing overflowing to blank the line off, and disconnect the lines to the shore lines.

5.5.4 Closing openings

1. All appropriate tank openings should be exactly closed by using the designated tools after the completion of the cargo loading / unloading. **THIS OPERATION MUST BE CARRIED OUT BY PUMPMAN OR BOSUN UNDER CHIEF OFFICER OR RESPONSIBLE OFFICER CONTROL.**

5.5.5 Earthing / bonding

1. Connecting cables to the shore should be taken off after the cargo hoses are disconnected.

5.5.6 Gas detection

During the cargo loading / unloading, the spaces in which dangerous gas concentration may be accumulated, such as the machinery spaces, cargo pump room, accommodation spaces manifold area etc. should be gas-detected and ensured that there is no dangerous gas concentration. **(Apply atmosphere Monitoring)**

Long as far as possible by taking account into water hammering the transferring flow is to be set minimum as far as possible.

5.6 TESTING OF TANKS AND CARGOES :
The following pages describe and discuss some of the most common tests and checks that are made on oil and chemical cargoes including testing walls for cleaning.

Testing is normally carried out by independent surveyors who, according to local practice or a written agreement in the charter party, are accepted by shipper, receiver and owner.

If possible one of the ship’s deck officers should take part in the cargo sampling, cargo testing, tank cleanliness, examination etc. He should make notes and observations on the work of the surveyor with a view of protecting his party’s interests. It is therefore necessary to have general knowledge of the various procedures, without necessarily being able to carry them out himself. In the following text, however, there will be mentioned tests which are easily carried out by the ship’s staff by relatively simple means. A small laboratory with a stainless steel sink, a rack for 10-20 bottles of chemical reagents, test tubes (nessler tubes) and a supply of distilled water are an advantage to have on board.

In some remote ports independent surveyors may not be available. This gives the chief officer added responsibility in following the shipper’s or receiver’s instructions particularly if he is requested to sign their protocol etc.

Described below are number of tests which are commonly used by surveyors. Most of the tests are of a physical nature and are relatively easy to carry out on board. Normally the test results do not give any exact answers as to contamination etc. but have to be judged in relation to commonly accepted standards in industry or agreed values between parties. Furthermore, the answers are often only incidences of contamination. In case of any disagreement full laboratory examinations may have to be carried out. It is then of the utmost importance that the ship secures samples, sealed by an independent surveyor or by both parties, of the cargo parcel in question for further analysis.

The text below often refers to ASTM – Standards (American Society for Testing and Materials). The standards are contained in a series of updated books.

Similarly API (American Petroleum Institute) issues various standards, which are generally applied.

All measurements and tests have their tolerances, usually rather widespread and with correspondingly great economic consequences. It is good practice to take all readings twice, repeat important tests twice etc.

With ships engaged in special trades it might be useful to able to carry out the more common tests on board and to train personnel correspondingly. This refers in particular to the testing of tank walls for cleanliness. Many delays can be avoided if the ship’s officers can satisfy themselves that the tanks are properly cleaned before entering port, using the same methods as the surveyor coming on board does.

5.6.1 Sampling Of Cargo:

Cargo samples are taken for the purpose of the checking whether the cargo satisfies a given specification or not. Samples are also taken to establish if contamination has occurred during the voyage, during loading or unloading or prior to loading.

After examination of the tanks, mudboxes, piping etc. (as far as possible) for cleanliness it is usual to load sensitive chemicals into the ship’s tanks to a level of approximately 30 cm. and then take the samples from the tanks, presuming that any previous residues in the piping are by then dissolved into the new cargo (“soak test”). Similarly samples are taken from an initial discharge into container tanks or similar located on the shore before commencing unloading at full rate to the shore storage tanks.

If a “soak test” upon loading is turned down by the surveyor or the shipper and loading stopped, the chief officer should then request sealed and identified samples of the cargo lot in question, from the ship’s tanks as well as from the shore tanks. By these means the ship owner may be able to protect his interests in case of any dispute.

Sometimes drip samples are taken from the loading manifold during loading. This method is simple, but not always fully representative. The pumping rate may vary during the transfer, whilst the sampling rate is more or less constant. Furthermore it is difficult to guarantee the proper identify of sample taken over a long period of time. This is not meant to discourage the ship’s officers from taking a drip-sample during loading may be the only way to establish whether a cargo was contaminated during the pumping on board or ashore.

Before unloading cargo samples are normally taken from the ship’s tanks.

The cargo samples should be sealed and marked on board, particularly if no independent surveyor is present. The ship should keep one sample for future reference in case of any disputes arising. The sample should be stored in a dark and cool room especially put aside for this purpose. The room should have steel bulkheads and be open to the weather deck.
Samples of products which deteriorate or chance with times (e.g. styrene, vegetable oils) have limited purposeful storage time on board. With e.g. phosphoric acid, the samples may remain representative as regard chemical composition, but may not be so as regards contents of sediments. However, normally the samples are stored one year, which is the normal respite for making and claim.

Sampling at deep levels is carried out with containers which are lowered upside down or have valves or other means of filling themselves up at the deeper level. Sampling at various different levels is necessary for products which have a tendency to stratify, viz. phosphoric acid which may contain a higher percentage of solids near the tank bottom than at top level.

### 5.6.2 Cargo Temperature Determination:

The temperature difference between the top and bottom of a tank may be considerable. This applies particularly to shore tanks, where the ship’s officers are sometimes requested to attend when readings are being taken. ASTM standard D 1085-65 (API 2545) Rules that temperature readings are to be taken at three levels when the tank depth exceeds 4.5 m. Ordinary thermometers should be kept immersed at least 5 minutes at each level.

As regards skin-contact dangerous products such as phenol, ACN etc., one should, if possible, avoid handling contaminated thermometers. Readings are much better taken by means of thermometers pocketed in the discharge manifold. Glycerine or other suitable contact medium should be filled in the pocket in order to give a good thermal contact.

Simple, portable, remote reading thermometers which can be lowered into the tank would be a welcome development.

### 5.6.3 Specific Gravity, Density:

Specific gravity expresses the weight of a unit volume of a matter compared with the weight of the same volume of water, both at a defined (but sometimes different) temperature. Expressions such as SG 20/20 are used in the petroleum industry. The first figure denotes the temperature of the product and the latter the temperature of the water used as a compression. Specific gravity includes the effect of air displacement.

The specific gravity of water varies as follows:

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Specific Gravity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>1.0000</td>
</tr>
<tr>
<td>15</td>
<td>0.9982</td>
</tr>
<tr>
<td>20</td>
<td>0.9913</td>
</tr>
</tbody>
</table>

If a specific gravity SG 20/20 deg. C is to be converted to SG 20/4 deg. C (4 deg. C is a common reference temperature) multiply as follows:

\[
\frac{0.9913}{1.0000} = \text{SG } 20/4 \times \frac{\text{SG } 20/20}{1.0000}
\]

Other examples:

\[
\frac{0.9913}{1.0000} = \text{SG } 15/4 \times \frac{\text{SG } 15/20}{1.0000}
\]

\[
\frac{0.9913}{0.9982} = \text{SG } 15/15 \times \frac{\text{SG } 15/20}{0.9982}
\]

The tendency is now to use metric units in cargo calculations. The expression specific gravity is then substituted by density and weight with mass. Density is expressed in absolute figures viz. kg/m³ at a defined temperature.

A recalculation from specific weight to density involves a correction for the displacement in air by means of a “vacuum factor”:

\[
\frac{\text{Specific Gravity}}{\text{Vacuum Factor}} = \text{Density}
\]
The vacuum factor varies slightly with density (specific gravity):

<table>
<thead>
<tr>
<th>Density</th>
<th>Vacuum Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0</td>
<td>1.00108</td>
</tr>
<tr>
<td>0.9</td>
<td>1.00122</td>
</tr>
<tr>
<td>0.8</td>
<td>1.00139</td>
</tr>
<tr>
<td>0.7</td>
<td>1.00161</td>
</tr>
</tbody>
</table>

The difference between density and specific gravity is, as can be seen, small. An error in application gives a discrepancy of about 12 m³ for cargo of 10 000 m³ (at SG 0.9).

Density (and specific gravity) is measured by means of an aerometer (hydrometer) or pycnometer.

The aerometer consists of a displacement body with a graduated scale. The accuracy in reading gives a maximum of three correct figures. The fourth figure being doubtful. This means an accuracy of 0.1-0.2%. This accuracy is generally insufficient for cargo quantity determination. The aerometer is, however, well suited as an instrument for a general check of cargo density onboard. A set of aerometers for density ranges 0.7 to 1.0 and 1.3 to 1.8 (alkalies and acids) should be onboard.

The pycnometer consists of a small glass retort with an accurately determined volume (certified pycnometers available). The specific gravity is determined by weighing the pycnometer empty and filled with liquid. The result is obtained with five correct figures which is much better than the aerometer principle. The determination is generally made at 20 deg. C. The use of pycnometers onboard is non-practicable due to the need for a very sensitive weight scale.

Specific weight/density is part of all product specifications as a check on concentration, mixture, etc. The SG/Density falls with the rising temperature. Volume correction factors are used for recalculation (per C or F) or tables (for petroleum products) available from API.

A warning: It sometimes happens that cargo density and thus the quantity is determined at both the loading end and the discharge end by means of aerometers. Obviously, therefore, there will be discrepancies in two quantity determinations simply due to the relatively poor accuracy in the density readings. As a result, questions regarding cargo claims may arise. The answer is to use the “as loaded density” (whether completely correct or not) and correct it for the change in temperature at the discharge end. This “calculated” density is then used in the quantity determination upon discharge. Thereby it can be established with good accuracy whether cargo has been lost or not.

There are also other specific gravity scales. Conversion can be carried out thus:

a) API-scale, commonly used for the petroleum products:

\[
\text{API -Gravity (at 60 deg. F) = } \frac{141.5}{\text{SG at 60/60 deg. F}} - 131.5
\]

b) Baume-scale, used for liquids heavier than water e.g. sulphuric acid:

\[
\text{SG } = \frac{145}{(145-\text{deg. Baume})}
\]

There is also a Baume-scale for liquids lighter than water.

5.6.4 Colour Determination:

Most products shipped in chemical tankers are pure and well defined. The colour is known and any deviations indicate the presence of contaminants.
Most chemicals, furthermore, are clear and translucent. A milky or turbid appearance indicates that contaminant may be present.

A sample is best studied in a test tube against a black or white background in good daylight.

Empirically a number of colour scales have been established. They are each particularly suited for certain kinds of products.

A method called APHA (Hazen) is often used for very light products, defined in ASTM D-1209, viz aromatics, ketones. This colour scale is defined with an origin in 100 cc distilled water (value 0) to successively higher values (max 500) by adding APHA solution (a platinum-cobalt salt solution). The number of cc APHA solution (min 5 cc) added to the distilled water gives the APHA colour shade number. A comparison is made against a white background with a product sample in one test tube and a matching APHA solution in another. This method can easily be carried out on board. APHA solutions are best bought from a laboratory, already premixed for a number of shades.

The Saybolt colour scale uses coloured glasses against which the sample is compared in a defined apparatus. The colour scale goes from plus 30 (lightest) to minus 16 (darkest).

The Saybolt scale is widely used in the petroleum industry.

The method is defined in ASTM D156-64. The Saybolt method requires a special apparatus, is somewhat complicated and not particularly suited for use on board ships.

The Gardner scale uses sealed reference tubes for comparison with samples in a tube of the same diameter. The Gardner scale goes from 1-18 and is defined in ASTM 1544-63 T.

The Lovibond scale has several different colours (yellow, blue, red) and uses a test cell with a variable depth. This method is used for e.g. vegetable oils.

ASTM D 1500, Previously called NPA, defines colour scale and an apparatus suitable for field work and application on board. A test sample is compared with coloured glasses in revolving magazine. The scale goes from 1 (water) to 8 (extra dark red). The name “NPA grade........” is still often used in shipping when a prospective cargo is circulated or when vessels’ cleanliness is described. A cargo may be accepted at NPA 2, with discharge permitted at NPA 2 1/2. A certain amount of degradation in such a case can be permitted.

With a colorimeter on board one can take samples and by experience get an idea of how much of the previous cargo residues can be left unattended without risk for cargo claims (refers to petroleum cargoes rather than to chemical products).

COLOUR SHADE EQUIVALENTS:

<table>
<thead>
<tr>
<th>N..P.A</th>
<th>SAYBOLT</th>
<th>COLOUR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ 30</td>
<td>Water white</td>
</tr>
<tr>
<td></td>
<td>+21</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ 16</td>
<td></td>
</tr>
<tr>
<td></td>
<td>+ 1</td>
<td>Std. White</td>
</tr>
<tr>
<td></td>
<td>- 11</td>
<td>Lily white</td>
</tr>
<tr>
<td>1</td>
<td>- 24</td>
<td>Cream white</td>
</tr>
<tr>
<td>1 1/2</td>
<td>- 32</td>
<td>Extra pale</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>Extra lemon pale</td>
</tr>
<tr>
<td>2 1/2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>3 1/2</td>
<td>Extra orange pale</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 1/2</td>
<td></td>
<td>Pale</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>Light Red</td>
</tr>
<tr>
<td>6</td>
<td>6</td>
<td>Dark Red</td>
</tr>
<tr>
<td>7</td>
<td>7</td>
<td>Claret Red</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>Extra dark red.</td>
</tr>
</tbody>
</table>
5.6.5 Acid Wash:

This method is used to determine if petroleum hydrocarbons are present in aromatic compounds. Aromatics (e.g. toluene, xylene, benzene) are unaffected by sulphuric acid, but oils and most other contaminants are affected, causing a discoloration. The method is suited for applications on board and can be used as a check that proper tank cleaning has been accomplished. The method is defined in ASTM D 848-62.

A test tube is filled with 7 cc. conc. (96%) sulphuric acid, and on top of which is filled 21 cc of the product sample. The tube is then shaken 40-50 sec. (150 times) and is then left to settle for a period of time. The colour of the acid in the bottom of the tube is then compared with the standard shades where 0 corresponds to water and 14 to a dark yellow colour.

The acid wash method is used if there is any suspicion that a cargo of aromatic may have been contaminated by a previous cargo.

The method is also used as a check that a tank is sufficiently cleaned before loading aromatics. A surface of about one m² is carefully cleaned with clean cotton and an aromatic, eg. toluene, and the liquid wrung out and tested as the cargo sample mentioned above. One can also take rust sediments (uncoated tanks) and dissolve any oil contaminants by means of toluene, which is then tested by this method.

Finally difficult question arises: how much of cargo contaminants can be tolerated on the tank wall? Make tests and train your own judgement!

5.6.6 Dissolving Contaminants From Rust:

As a rough check if cargo residues hidden in rust may discolor a cargo to be loaded, the following check can be made: Break the rust into pieces, 0.5 - 1.0 cm in size, and place them in a clean bottle. Add some of the product to be loaded (or other similar available product) and leave for 5 min. If no discoloration has occurred by then, shake the bottle vigorously and leave for another 15 min. If still no discoloration appears the tank could be cleared for loading. If there is a discoloration: filter the contents through double filter papers in order to remove any possible suspended rust particles. A non-discoloured liquid after filtering should also clear tank for loading. A discoloration means that the tank requires further cleaning.

Observe: this simple test does not necessarily clear a tank for loading of e.g. aromatics, but it may prevent you from trying.

5.6.7 Hydrocarbons In Methanol-Water Miscibility Test:

Metanol is very sensitive to oil contaminants. The following test method uses methanol as a testing medium. The methanol must therefore be guaranteed free from any hydrocarbons contaminants.

About one m² of the tank wall is carefully washed with cotton and about 40 cc. methanol. The methanol is wrung out and put into a test tube. Then 60 cc distilled water is added. The mixture is well shaken and left to settle for 20 min. If the solution remains a clear liquid the tank wall can be considered to be clear, but if the solution has turned milky or only slightly milky it is an indication that the tank should be cleaned again before loading methanol or any other oil-sensitive cargo.

This method should be a standard practice to be carried out by the ship’s personnel. The method can, of course, also be used as a check on the cargo upon loading and discharging.

CHLORIDES:

Certain cargoes are very sensitive to chloride contamination in particular glycols, methanol, ethanol. As mentioned before the tanks should be finally washed with fresh water. However, chlorides (salt) may still be present and a check might be useful. The greatest risk for salt deposits is on horizontal surfaces.

The following method utilises the well known principle that chlorides form a milky solution when silver nitrate is added. (as commomnly used when checking the boiler feed water).
About one m² of a suspected tank wall is cleaned by means of cotton wool and distilled water. The water is filtered through a funnel into a test tube. The tube is then filled to a total volume of 100 cc with distilled water and well mixed. Another reference test tube is filled with 100 cc of distilled water. To both tubes are then added 5 drops of silver nitrate solution and the tubes well shaken. If chloride are present the sample tube will show a milky appearance. To the reference tube is then added a standard (known) chloride solution in small amounts by means of a pipette until turbidity is the same in both test tubes. With a known chloride contents in the standard solution and a known added amount one can calculate how many grams of chlorides were present on the one m² of the tank wall. The total amount of chlorides in the tank can thus be evaluated. This amount divided with the tank tonnage gives an idea of increase of chloride contents. (if no other sources of contamination occur during the voyage). If the test tubes turns out to be too milky for comparison (which means a concentration of above some 100 ppm) its contents can be diluted with a known amount of distilled water and the calculation corrected correspondingly.

ASTM D 512 describes in detail a standard chloride determination.

As an example it can be noted that some specification allow 0.3 ppm of total chlorides contamination (ethanol). This corresponds to 0.3 kg. in 1000 tons of products. The permitted increase during transportation is only a fraction thereof. A similar method is used for the determination of chlorides in clear water-soluble products, such as alcohols. To 50 cc of distilled water is added a few drops of nitric acid (HNO3) and 2 cc of saturated silver nitrate solutions, then mixed with 50 cc of the product to be tested, e.g. methanol.

A milky appearance indicates that chloride are present. Reference tests have to be carried out with the same product with known contents of chlorides if exact values of contamination are needed.

### 5.6.8 Water Contamination:

Presence of free water in non water-soluble can very roughly be determined on board by the following simple methods.

- Warm a sample of the product in a test tube or in a bottle. Water will then collect at the bottom of the tube and can be seen after some time.

- Drop a little of the product on to an electric hot plate. A crackling sound indicates that water is present. Can be used on lubrication oils etc.

Other methods for non water-soluble products are:

- The product is kept at a temperature slightly above 100 deg. C for period of a time and is accurately weighed before and after heating (for products with a boiling point above about 125 deg. C)

- Use a centrifuge and see if there is any water at the bottom of test tube.

- A distillation method according to ASTM D 95-62 (Dean stark) is often used for oil products with relatively high boiling points (fuel oils, gas oil, asphalt). A sample is dissolved in xylene and solution boiled in a glass retort. The vapours pass through a condensor. The water condenses and can be measured in a graduated tube.

An accurate determination of water contents can be made with a "Karl-Fischer" reagent. This method is suited for laboratory work only.

Very small amounts of water in some products can be observed as a turbidity in a clear liquid when a sample is cooled down to a low temperature (cloud point). As a reference calibrated samples are used with known water contents at defined temperatures. The method is used primarily for chlorinated hydrocarbons such as carbon tetrachloride and trichlorethlene where water might be a severe contaminant also in minute concentrations of e.g. 0.006 %. (remark: "cloud point" also means the temperature at which wax needles may form in certain oils, e.g. in gas oil, upon cooling. See ASTM D 2500-66.

For ethyl methyl ketone (MEK) the presence of water can be proven by adding a drop of oil. If the sample turns a brownish colour there is water in it.
5.6.9 Odour:

An unusual smell is an indication of cargo contamination and should be reported when it is noticed upon loading. For normally odour-free products such as glycol, odour may be a severe contamination in itself.

In order to check products which have a strong “natural” odour one can moisten a filter paper with the product and let the liquid evaporate. If a strange odour should then arise from the filter paper it is an indication of a contamination (by a product with a higher boiling point than the cargo in question).

5.6.10 Sulphur Contamination:

Certain products, in particular “virgin naptha feed stock” (petroleum naptha) are severely contaminated by minor amounts of sulphides (and also lead compounds) which poison catalysts in further processing. Previous heavy oils or dirty harbour ballast water may have left traces of sulphides in the cargo tanks.

Usually sulphides are detected by means of “copper strip test” according to ASTM D 130-65. A polished copper strip is immersed in the product during a period of 2-3 hours at 100 deg. resp. 50 deg. C. If sulphides are present the copper will become darkened and can be compared with ASTM standard shades where 0 means no discoloration, 1-3 increasing discoloration and 4 corrosion. Usually, however, the test is used as a “yes or no”-test without mentioning figures. The method is easily applicable on board.

Another less frequently used method uses mercury. A small amount of the product is mixed together with mercury in a test tubes. If sulphide are present the mercury will turn a brownish colour. The use of ............. should, however, be avoided.

5.6.11 Flash Point:

The flash point is a measure to show at what temperature flammable vapours are released in appricable amounts. The flash point means that the product has been contaminated with a more volatile product, which is a severe contamination. A redistillation of the parcel may become necessary. Flash point lowering is of particular concern with cargoes of type jet fuel oil, gas oil, marine diesel oil.

Flash point determination is carried out by means of the Pensky-Martens apparatus described in ASTM D 93-66 and well known in all petro chemical laboratories. A product sample is successively heated and in the vapour space above the liquid a standard ignition flame is introduced at regular intervals until an ignition occurs. Two methods are used: open cup (oc) respectively closed cup (cc). The latter gives a lower flash point with a difference of 5-7 deg. C. Closed cup is the most commonly used method.

5.6.12 Distillation Range:

Any pure liquid has a defined boiling point. Commercial products often consist of mixtures with also other compounds in accepted amounts. Boiling of a commercial products therefore means that the more volatile components will boil off first and the heavier components later and at higher temperature. This results in a range in temperature between commencement of boiling and finished boiling (dry retort), called “distillation range”. The distillation range is defined in the specification for a certain product parcel. Deviations indicate that product has been contaminated.

The test equipment is defined in ASTM D 1078, D 1437 and E 133-58. 100 cc. of the product is heated to boiling in a retort and the vapours condensed in a water-cooled condensor. A thermometer is inserted in the vapour stream.

The initial boiling point (IBP) is defined as the temperature at which the first drop is condensed in the condensor. The initial boiling point is read when the retort just becomes dry, dry point (DP). For certain products, particularly gasolines, the final boiling point is read when the last drop leaves the condensor, end point (EP).

The distillation range then becomes:

\[ t = IBP-EP \] (in general)

\[ t = IBP-DP \] (gasolines)

This test is used on all hydrocarbons: alcohols, aromatics, esters, ketones, glycols etc. The method is best suited for laboratoies ashore.
5.6.13 Refractive Index:
This method is based on the property of light to be refracted at different angles when it passes a prism into different liquids. This test is realized in an instrument called a “refractometer” where only a drop of the liquids to be tested is needed to cover the surface of the prism. The refractive angle can be measured with a good accuracy.

The angle of refraction is a typical property for every pure product. The method is sensitive to temperature. Usually a standard temperature of 20 deg.C is used, but temperature corrections can also be made.

Standards are defined in ASTM D1747-62. Refractometers are available in laboratory and portable models. The latter can easily be used on board.

There are tables available against which refractometer reading can be interpreted in terms of concentrations.

The refractive index of a mixture of two products is proportional to the relative contents of the products. Therefore the instrument is suitable to determine strength of solutions, e.g., sugar in water (molasses) or glycol in water. It is also used for the determination of hydrocarbons mixtures (aromatics) and vegetable oils.

5.6.14 Solidifying Point:
The solidifying point (freezing point) is well defined for pure products. Deviations indicate that contaminants are present.

The solidifying point is measured by placing a test tube with a thermometer in a cooling bath. The product is kept stirred and the temperature is read at short internals. It will fall to a minimum and afterwards rise slightly and remain constant for a while. This temperature is defined as the solidifying point.

Examples on solidifying point:
Benzene + 5.4 deg.C
Cyclohexane + 4.6 “
Paraxylene + 13.2 “

5.6.15 Permanganant Time Test:
This is a test to determine contaminants in alcohols and ketones (e.g., acetone) The method is described in ASTM D 1303 -67.

2 cc. potassium permanganate solution (conc.:0.2 g KMNO4) dissolved in 1 litre of distilled water) is added to a 50 cc. sample in a test tube. Contaminants in the sample chemically reduce the potassium permanganate which changes colour from red to yellowish. The time is noted for the sample to assume the same shade as a standard reference solution of coboltchloride-uraninitrile. A shorter time for this colour change means a greater amount of contaminants. Acetone is tested at 25 deg.C, methanol at 15 deg.C. The test tube should be kept dark during the test.

After some practice this method can be carried out on board, and is in fact already in use in some ships.

5.6.16 Gas Chromatography:
In a gas chromatography a small product sample is injected and made to pass through a pipe filled with a very fine mineral powder by means of a carrier gas stream (N2, H2, He, argon). Temperature is kept constant. The lighter components will pass through the tube easily but the heavier ones will take more time. In this way the components are separated at the outlet where an ion-cell picks up an electric signal which is recorded. Each product has a typical “print”. Deviations indicate contaminants.

The method is only suitable for laboratory work ashore.

A gas chromatograph test from product samples taken prior to loading and upon discharge can tell if contamination has occurred while the cargo was on board. This method is sometimes used taking “fingerprints” from an oil spill and from a suspected source in order to establish the origin of a pollution.

5.6.17 Ph VALUE (ACIDITY):
A neutral solution is defined as pH=7. Acidous solutions have pH lower than 7 and alkaline solutions higher than 7 (max 14).

Water soluble products are readily tested by means of litmus paper where a colour change directly indicates the pH-value roughly. There are also electrode-meters available where the pH-value can be read directly from a scale.

The pH-value can also be established by means of neutralization with a sodium hydroxide (caustic soda) solution from which the acidity can be calculated from the amount of alkaline matter added. A colour reagent shows when the solution changes from acidous to alkaline.

Vegetable and animal oils require the determinations of pH value, which indicates the contents of free fatty acids. This is, in turn, a measure of the quality of the oil, or the degradation of the oil during transport. The oil is first dissolved in alcohol and afterwards neutralised with sodium hydroxide as indicated above. The method is described in BS 628-32.

5.6.18 Viscosity:

Viscosity is measured by means of capillary tubes (ASTM D 445 -IP) or by an apparatus measuring the friction of liquid between two cylinders of which one is revolving. Measurements on board will rarely be needed.

Viscosity is interesting as regards the pumpability of a product. Usually the upper limit for the centrifugal pumps is considered to lie around 400 centisoke (cSt), corresponding to about 1500 seconds Redwood (sec R) or about 50 degrees Engler (E deg.). Screw pumps may pump liquids with viscosities as high as 10000-20000 cSt.

5.6.19 Spectro Photometry:

A spectro photometer is used to trace minute contaminants (1-2 ppm). One common application is the determination of degree of polymerisation in styrene monomer.

The principle of the instrument is that a product sample is translated with a light of a known wave length (ultra violet visible or infra red light). A certain part of the light is absorbed and does not reach a detector cell. The amount of absorption is known for pure products. For common contaminants there are calibration curves available for comparison with readings.

5.7 PRECAUTIONS FOR EACH CARGO

In addition to the precautions are premised on the perfect cargo tank and pipe line cleaning prior to operation.

5.7.1 Sulphuric acid and oleum

Since sulphuric acid is very reactive with other cargo and of a substance with compatibility with water, care should be paid for handling sulphuric acid. Before loading sulphuric acid the adjacent double bottom tanks must be discharged and stripped well.

1. Loading
   (i) Ensure the working condition of the breather valve and the lever position.

   (ii) Fit a blank flange for heating coils.

   (iii) Fill the compressed air into the heating coil and ensure the pressure.

   (iv) When monitoring within the use of the high level alarm system and high high level alarm system, secure the working condition of the alarm system.

   (vi) Fit a guard cover to the manifold connection to prevent the danger due the bursting.

   (ix) Connect the cargo line intended to use to shore cargo line at the manifold connection and then open or close necessary valves for handing the cargo.

   (x) All persons engaged in the work should wear protective equipment. (see 7.9)

2. During loading
   (i) Monitors the levels by means of the level indicating system and the high level alarm system, high high level alarm system.

   (ii) Also see item 5.4 “General cargo handling during loading / unloading”.

3. After loading
(i) After loading, transfer the residual liquid in the cargo line, the shore installation, or the cargo tank of this ship with the use of compressed air.

(ii) Also, see item 5.5 “General operation after completion of loading / unloading”.

4. During voyage

(i) Monitor the temperatures inside cargo tanks

(ii) Secure the air filling pressure in the heating coil.

5. Before / during / after unloading

see the general precautions mentioned in 5.3 to 5.6

5.7.2 Glacial acetic acid, Formic acid, Procionic acid

1. Before loading

(i) Secure the working condition of breather valve and the lever position.

(ii) Secure the working of high level alarm system in the case of monitoring by means of the high level alarm system as prevention of overflow.

(iii) Fit a guard cover to the manifold correction to prevent the danger due to bursting.

(iv) Connect the cargo line intended to use to the shore cargo line at the manifold correction and than open or close necessary valves for handling the cargo.

(v) All persons engaged in the work should wear protective equipment. (see item 7.9)

2. During loading

(i) Monitor the level by means of the level indicating system and the high level alarm system.

(ii) Also, see item 5.4 “General cargo handling during loading / unloading”.

3. After loading

(i) After loading, close all the valves used and disconnect the cargo lines from the shore lines.

(ii) Also, see item 5.5 “General operation after completion of loading / unloading”.

4. During voyage

(i) Monitor the temperatures inside cargo tanks

(ii) Spray water on deck to prevent the temperature monitor panel.

5 Before / during / after loading

See the general precautions mentioned in 5.3 to 5.5.

5.7.3 Phosphoric acid (dry process)

1. Before loading

(i) Secure the working condition of breather valve and the lever position.

(ii) Fill the compressed air into the heating coil and secure the pressure.

(iii) Secure the working of high level alarm system in the case of monitoring by means of the high level alarm system as prevention of overflow.

(iv) Fit a guard cover to the manifold connection to prevent the danger due to bursting.

(v) Replace the tank filling line and with the circulator. (if there is and according ins.)

(vi) Connect the cargo line intended to use to the shore cargo line at the manifold connection and then open or close necessary valves for handling the cargo.

(vii) All persons engaged in the work should wear protective equipment. (See item 7.9).
(viii) Also, see item 5.3 “Precautions before loading / unloading”.

2. During loading
   
   (i) Monitor the levels by means of the level indicating system and the high level alarm system.
   
   (ii) Also, see item 5.4 “General cargo handling during loading / unloading”.

3. After loading
   
   (i) After loading, close all the valves used and disconnect the cargo lines from the shore lines.
   
   (ii) Also, see item 5.5 “General operation after completion of loading / unloading”.

4. During voyage
   
   (i) Monitor the temperatures inside cargo tanks.
   
   (ii) Secure the air pressure filled into the heating coil.
   
   (iii) Spray water on deck to prevent the temperature from raising.
   
   (iv) Monitor the circulation system due to the cargo pump.

5. Before / during / after loading
   
   See the general precautions mentioned in 5.3 and 5.6.

5.7.4 Acrylonitrile, Aniline and other toxic chemicals

1. Before loading
   
   (i) Secure the working condition of breather valve and the lever position.
   
   (ii) Fill the compressed air into the heating coil and secure the pressure.
   
   (iii) Secure the working of high level alarm system.
   
   (iii) Connect the gas purge line of the event line for the cargo tank intended to carry to the shore installation for returning the cargo vapour to shore and then open the valves at the connection.
   
   (iii) Connect the cargo line intended to use to the shore cargo line at the manifold connection and then open or close necessary valves for handling the cargo.
   
   (vi) All persons engaged in the work should wear protective equipment. (See item 7.9)
   
   (vii) Also, see item 5.3 “Precautions before loading / unloading”.

2. During loading
   
   (i) Monitor the level by means of the level indicating system and the high level alarm system.
   
   (ii) Also, see item 5.4 “General cargo handling during loading / unloading”.

3. After loading
   
   (i) After loading, close all the valves used and disconnect the cargo lines from the shore lines.
   
   (ii) Close the valves of the vapour return line at the vent line and disconnect the connections from the shore installation.
   
   (iii) Also, see item 5.5 “General operations after completion of the loading / unloading”.

4. During voyage
   
   (i) Monitor the temperatures inside cargo tanks
   
   (ii) Secure the air pressure filled into the heating coil.
   
   (iii) Spray water on deck to prevent the temperature from raising.
   
   (iv) Examine the blockage condition of breather valve and frame arrester on periodical.

5. Before / during / after loading
   
   See the general precautions mentioned in 5.3 to 5.5.
5.7.5 Chloroform and epichlorohydrin

1. Before loading
   (i) Secure the working condition of breather valve and the lever position.
   (ii) Fill the compressed air into the heating coil and secure the pressure.
   (iii) Secure the working of high level alarm system.
   (iv) Connect the gas purge line of the vent line for the cargo tank intended to carry to the shore installation for returning the cargo vapour to shore and then open the valves at the connection.
   (v) Connect the cargo line intended to use the shore cargo line at the manifold connection and than open or close necessary valves for handling the cargo.
   (vi) All person engaged in the work should wear protective equipment. (See item 7.9)
   (vii) Also, see item 5.4 “General cargo handling during loading / unloading”.

2. During loading
   (i) Monitor the level by means of the level indicating system and the high level alarm system.
   (ii) Also, see item 5.4 “General cargo handling during loading / unloading”.

3. After loading
   (i) After loading, close all the valves used and disconnect the cargo lines from the shore lines.
   (ii) Close the valves of the vapour return line at the vent line and disconnect the connections from the shore installation.

4. During voyage
   (i) Monitor the temperatures inside cargo tanks.
   (ii) Secure the air pressure filled into the heating coil.
   (iii) Spray water on deck to prevent the temperature from raising.

5. Before / during /after loading
   See the general precautions mentioned in 5.3 to 5.6.

5.7.6 Phenol 1.4 - Dioxane, Acrylate acid and Ethylene dibromide

1. Before loading
   (i) Secure the working condition of breather valve and the lever position.
   (ii) Before using the heating coil, inspect the cargo tank intended to use by detecting gas and than secure there is no abnormality.
   (iii) Secure the working of high level alarm system.
   (iv) Connect the gas purge line of the vent line for the cargo tank intended to carry to the shore installation for returning the cargo vapour to shore and open the valves at the connection.
   (v) Connect the cargo line intended to use to the shore cargo line at the manifold connection and then open or close necessary valves for handling the cargo.
   (vi) All persons engaged in the work should wear protective equipment. (see item 7.9)
   (vii) Also, see item 5.3 “Precautions before loading / unloading”.

2. During loading
   (i) Monitor the level by means of the level indicating system and the high level alarm system.
   (ii) Also, see item 5.4 “General cargo handling during loading / unloading”.

3. After loading
   (i) After loading, close all the valves used and disconnect the cargo line from the shore line.
   (ii) Close the valves of vapour return line at the vent line and disconnect the connections from the shore installation.
(iii) Also, see item 5.5 “General operations after completion of loading / unloading.

4 During voyage

(i) Monitor the temperatures inside cargo tanks
(ii) Spray water on deck to prevent the temperature from raising

5 Before / during / after loading

See the general precautions mentioned in 5.3 to 5.6.

5.7.7 Dimethyl formamide, Methyl acrylate and Methyl metacrylate

1 Before loading

(i) Secure the working condition of breather valve and the lever position.
(ii) Fill the compressed air into the heating coil and secure the pressure.
(iii) Secure the working of high level alarm system in the case of monitoring by means of the high level alarm system as prevention of overflow.
(iv) Connect the cargo line intended to use to the shore cargo lines at the manifold connection and then open or close the necessary valves for handling the cargo.
(v) All persons engaged in the work should wear protective equipments.
(vi) Also, see item 5.3 “Precautions before loading / unloading”.

2 During loading

(i) Monitor the level by means of the level indicating system and the high level alarm system.
(ii) Also, see item 5.4 “General cargo handling during loading / unloading”.

3 After loading

(i) After loading, close all the valves used and disconnect the cargo lines from shore lines.
(ii) Also, see item 5.5. “General operations after completion of loading / unloading”.

4 During voyage

(i) Monitor the temperatures inside cargo tanks with the temperature monitor level.
(ii) Secure the air pressure filled into the heating coil.
(iii) Spray water on deck to prevent the temperature from raising.
(iv) Examine the blockage condition of breather valve and frame arrester on periodical.

5 Before / during / after loading

See the general precautions mentioned in 5.3 to 5.6.

5.7.8 Ethylene Dichloride

1 Before loading

(i) Secure the working condition of breather valve and the lever position.
(ii) Fill the compressed air into the heating coil and then secure the pressure.
(iii) Secure the working of high level alarm system in the case of monitoring by means of the high level alarm system as prevention of overflow.
(iv) Connect the cargo line intended use to the shore cargo lines at the manifold connection and then open or close necessary valves for handling the cargo.
(v) Also, see item 5.3 “precautions before loading / unloading”.

2 During loading

(i) Monitor the level by means of the level indicating system and the high level alarm system.
(ii) Also, see item 5.4 “General operations after completion of loading / unloading”.
3 After loading

(i) After loading, close all the valves used and disconnect the cargo lines from shore lines.
(ii) Also, see item 5.4 “General cargo handling during loading / unloading”.

4 During voyage

(i) Monitor the temperatures inside cargo tanks with the temperature monitor panel.
(ii) Secure the air pressure filled into the heating coil.
(iii) Spray water on deck to prevent the temperature from raising.

5 Before / during / after loading

See the general precautions mentioned in 5.3 to 5.6.

5.7.9 Benzene, Formaldehyde and Caustic Soda

1 Before loading

(i) Secure the working condition of breather valve and the lever position.
(ii) Before using the heating coil, secure that there is no abnormality by checking the sample.
(iii) Secure the working of high level alarm system in the case of monitoring by means of the high level alarm system as prevention of overflow.
(iv) Fit a guard cover to the manifold connection to prevent the danger due to bursting.
(v) Connect the cargo line intended to use to the shore cargo lines at the manifold connection and then open or close necessary valves for handling the cargo.
(vi) All persons engaged in the work should wear protective equipment. (see item 7.9)
(vii) Also, see item 5.3 “Precautions before loading / unloading”.

2 During loading

(i) Monitor the level by means of the level indicating system and the high level alarm system.
(ii) Also, see item 5.4 “General cargo handling during loading / unloading”.

3 After loading

(i) After loading, close all the valves used and disconnect the cargo lines from shore lines.
(ii) Also, see item 5.5 “General operations after completion of loading / unloading”.

4 During voyage

Monitor the temperature inside cargo tanks with the temperature monitor panel.

5 Before / during / after loading

See the general precautions mentioned in 5.3 to 5.6.

5.7.10 Styrene monomer

1 Before loading

(i) Secure the working condition of breather valve and the lever position.
(ii) Fill the compressed air into the heating coil and then secure the pressure.
(iii) Secure the working of high level alarm system in the case of monitoring by means of the high level alarm system as prevention of overflow.
(iv) Fit a guard cover to the manifold connection to prevent the danger due to bursting.
(v) Connect the cargo line intended to use to the shore cargo lines at the manifold connection and then open or close necessary valves for handling the cargo.
(vi) All persons engaged in the work should wear the protective equipment.
(vii) Also, see item 5.3 “Precautions before loading / unloading”.

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2 During loading
   (I)  Monitor the level by means of the level indicating system and the high level alarm system.
   (ii) Also, see item 5.4 “General cargo handling during loading / unloading”.

3 After loading
   (I)  After loading, close all the valves used and disconnect the cargo lines from shore lines.
   (ii) Also, see item 5.5 “General precautions after completion of loading/ unloading”.

4 During voyage
   (I)  Monitor the temperature inside the cargo tanks
   (ii)  Secure the air pressure filled into the heating coil.
   (iii) Spray water on deck to prevent the temperature from raising.
   (iv)  Examine the blockage condition of breather valve and frame arrester on periodical.

5 Before / during / after loading

See the general precautions mentioned in 5.3 to 5.6.

5.7.11 Other cargoes

The cargoes not subject to the IMO Chemical Code should be handled in accordance with the precautions mentioned in 5.3 to 5.6 and the other requirements.

5.8 Cargoes requiring special treatment

5.8.1 Cargoes inhibited against self-reaction

Acrylonitrile, Methyl acrylate, n-Butyl acrylate, Acrylic acid, Methyl methacrylate, Ethyl acrylate, Styrene monomer, Vinyl acetate, Benzyl chloride, Butyl methacrylate, Chloroprene, 2-Ethyl hexyl acrylate, Ethyl Methyl acrylate, 2-Hydroxyethyl acrylate, Isobutyl acrylate and Methyl acrylic acid are subject to the requirements 4.10 of the IMO Code. This depends upon the chemical properties which are liable to be polymerised or resolved under special conditions such as temperature, exposure or catalyster contact. To reduce this tendency it is required to add a small amount of inhibitor to control the cargo tank inside of the environment of space adjacent to the cargo tank intended to use. Since these cargoes are subject to the requirement 4.18.1 of the IMO Code, they should not be load to the space adjacent to the cargo tank which is heated.

Care should be taken to the following items.

(1) Cleanness

Before loading, the responsible officer should insure that there are no traces of other substances which may promote self-reaction of the cargo to be loaded in the cargo tanks and the cargo systems.

(2) Certificate

Care should be taken to ensure that the cargoes are sufficiently inhibited to prevent polymerisation at all times during the voyage.

When the ship carries such cargoes, a certificate of inhibition in which the following items are shown should be given from the manufacturer of the cargoes.

   (I) Name and amount of inhibitor added.
   (ii) Date on which inhibitor was added and duration of its effectiveness.
   (iii) Any temperature limitations qualifying the inhibitor’s effective life-time, and
   (iv) The action to be taken should the period of voyage exceed the effective life-time of the inhibitor.

(3) Cargo vent system

The cargo vent systems should be regularly checked for adequacy of operation to avoid blockage from polymer build-up.

(4) These cargoes should not be loaded in the spaces adjacent to the cargo tank in which a cargo liable to resolve is heated. Also these cargoes should not be handled by the cargo line passing through the cargo tank in which heated cargo is
loaded.

(5) The cargoes such as Allyl chloride, Chloroform, 1,1-Dichloroetane, Propionaldehyde, should be avoided heating and the temperature should be always monitored and measured.

5.9 Gas-freeing and tank cleaning

5.9.1 General

This paragraph is concerned only with the safe conduct of gas-freeing and tank cleaning operations. Information is given from the shipper of the cargo to meet the degree of cleanliness that may be required by the shipper for product quality reasons.

(1) Supervision

Chief officer should supervise all gas-freeing and tank cleaning operations according to procedure GP-6.03. Information of the work programme should always be available to the officer of the watch.

(2) Emergency procedure

The data sheet giving the emergency procedure should be available to all concerned. Essential protective clothing equipment and clean water shower or spray arrangements in the event of contamination of personnel should be ready for immediate use. Fire appliances should be in good order and ready for immediate use.

(3) Equipment

The responsible officer should check that all equipment are in safe working order and remain so throughout the operation. Gas-freeing equipment preferably should be of a type which discharges the vapour to atmosphere with as high velocity as possible and in a vertically upward direction, thereby to minimise the risk of vapour accumulating on the deck.

(4) When the ship is not wholly free of flammable vapour, the recommendations set out in 5.2 of this manual should be observed. All portable electrical equipment should be examined for possible defects before being used. Special care should be taken to ensure that the insulation is undamaged and cables are securely attached. All equipment should be efficiently earthen.

(5) Tank atmosphere and tank cleaning/steaming etc.

Too lean Atmosphere

A flammable vapour mixture should be suspected within the tank or at any of its openings after the discharge of a flammable cargo with a flash point below 61°C, a combustible cargo carried at a temperature above its flash point or any cargo loaded into a tank that was not free of flammable vapour. Similarly, flammable vapour should be suspected in cofferdams or any other spaces into which such cargoes may have leaked. Harmful concentrations of vapour should be suspected in all of the above spaces when the cargoes that have been discharged have a vapour inhalation hazard. Officers must be aware of the possibility of static generation when low conductivity cargoes are handled and the need for reduced loading rates at the initial stages of loading a tank. They should also be aware of the need to allow a settling period after loading prior sampling and ullaging and the need earth gauging and sampling. Officers must take into consideration that steam can act as a static generator and for this reason steam should never be injected into a non inert tank until is has been washed and gas freed to a level less than 1% LEL. Before washing; the tank should be ventilated to reduce the gas concentration of the atmosphere to % 10 or less of the LEL. Atmosphere monitoring must be made at various levels and intervals. Ventilation and atmosphere monitoring should continue during washing. If the tanks has a venting system which is common to other tanks, the tanks must be isolated to prevent an ingress of gas from the other tanks. If portable washing machines are used all hose connections should be made up and tested for electrical continuity before washing is introduced into the tank. Connections should not be broken until after the machine has been removed from the tank. To drain the hose coupling may be partially opened and then re-tightened before the machine is removed. During tank washings regular atmosphere monitoring must be made at various levels and intervals. (must be recorded) Washing should be discontinued if the gas concentration rises to 50% of the LEL. Washing may be resumed when continued ventilation has reduced the gas concentration to 20% of the LEL and maintained it at or below that level for a short period. The tank should be kept drained during washing. Washing should be stopped to clear any build up of wash water. Re circulated wash water should not be used for tank cleaning purposes due to the possibility of electrostatic generation other than in fully inerted tanks. Steam should not be injected into the tank.
Chemicals additives may be employed provided the temperature of the wash water does not exceed 60 deg. Cel. (must be checked before using). Wash water may be heated. If the wash water temperature is 60 deg. Cel. or less, washing should be discontinued if the gas concentration reaches 50% of the LEL. If the wash water temperature is above 60 deg. Cel., washing should be discontinued if the gas concentration reaches 35% of the LEL. The tank should be kept drained during washing. Washing should be stopped to clear any build up of wash water.

Ropes made of synthetic polymers should not be used for lowering equipment into cargo tanks. Because of the hazard from the static electricity, the introduction of steam into cargo tanks should not be permitted where there is a risk of the presence of a flammable atmosphere.

It should be borne in mind that a non-flammable atmosphere cannot be guaranteed in all cases where steaming might be thought to be useful. If satisfactory atmosphere monitoring are not obtained ventilation must be resumed. Officers should be aware of the possible health hazard associated with use of tank cleaning chemicals/solvents which may have a low TLV. They should also be aware that tank cleaning chemicals will act as electrostatic generators and should therefore only be used to wash cargo tanks that are in a non-flammable condition.

**Undefined atmosphere**:

In an undefined atmosphere, the vapours in the tank may be in the flammable range. The only way to guarantee that an explosion cannot occur during washing in an undefined atmosphere is to make certain that there can be no source of ignition. The following precautions must be taken if the risk from static electricity is to be eliminated:

- No machine may have a throughput greater than 60 m3/h.
- Recirculated wash water must not be used.
- Chemical additives must not be used.
- Wash water may be heated but must not be above 60 C
- Steam must never be injected to the tank.
- Tank should be kept drained during washing. Washing should be stopped to clear any build up of washing.
- All hose connections must be made up and tested for electrical continuity before the washing machine is introduced into the tank.
- Connections should not be broken until after the machine has been removed from the tank. To drain the hose a coupling may be partially opened and then retightened before the machine is removed.
- Sounding and the introduction of other equipment must be done through a sounding pipe if fitted. If a sounding pipe is not fitted, it is essential that any metallic components of the sounding or other equipment are bonded and securely earthed to the ship before the introduction to the tank and remain so earthed until removed. This precautions should be observed during washing and for five our thereafter. If, however, the tank is continuously mechanically ventilated after washing, this period can be reduced to one hour.
- during this period:
  - an interface detector of metallic construction may be used if earthed to the ship by means of a clamp or bolted metal lug.
  - A metal rode may be used on the end of a metal tape which is earthed to the ship.
  - a metal sounding rod suspended on a fibre rope should not be used even if the end at the deck level is fastened to the ship because the rope cannot be completely relied upon as an earthing path.
  - Equipment made entirely of non-metallic materials may, in general, be used: e.g. a wooden sounding rod may be suspended on a rope without earthing.
  - Ropes made of synthetic polymers should not be used for lowering equipment into cargo tanks.

**Over rich atmosphere**:

The procedures for making a tank atmosphere over rich and thereafter water washing the tank involve special measures intended to prevent the ingress of air. This method of washing should only be carried out when authorised by the operator and under the supervision of a person who has received special training in these procedures.

Water washing must not be started, or if in progress must be discontinued and not re-started, if the hydrocarbon content of the tank atmosphere is less than 15% by volume.

(6) **Gas-free**

C. Officer should take all necessary considerations into account when deciding if a space is sufficiently free of vapour for any particular purpose.

It is generally recognised that tank cleaning and gas freeing is the most hazardous period of tanker operations. This is true whether washing for cleaning, gas freeing for entry or gas freeing for hot work. The additional risk from the toxic effect of chemical/petroleum gas during this period cannot be over emphasised and must be impressed on all concerned. It is therefore essential that the greatest possible care is exercised in all operations connected with tank cleaning and gas freeing.

(7) **Entry in tanks**

Entry into the tanks or other enclosed spaces should not be permitted except as provided in 7.3 of this manual.
(8) Opening up of cargo handling equipment

It should always be suspected, even after spaces have been cleaned and made gas free, that some cargo liquid or vapour or both will be released whenever pumps, cargo lines, valves, heating coil, etc. are opened up. Precautions should be taken against the effect of such release.

5.9.2 Precautions for gas-freeing and tank cleaning in port and at sea

Before gas-freeing and tank cleaning are begun, the responsible officer should in port, or when appropriate at sea, be satisfied that the precautions in 5.2 of this manual are being observed and also that:

i) No unauthorised work is being done in way of the cargo space.

ii) In port, appropriate personnel ashore have been contacted to ascertain that permission to operate alongside has been granted, that conditions are safe on the jetty and notice has been given that operations are about to start (in

iii) Seeking permission to tank cleaning alongside involving transfer of washingashore, shore representatives should be advised of the nature of all grades in the previous cargo).

(iv) Appropriate personnel on board have been duly instructed and notified that gas-freeing or tank cleaning is about to start.

(v) No unauthorized draft is alongside, and authorized drafts that are alongside are warned that cleaning is about to begin.

(vi) Any necessary hose connections to shore or draft alongside are properly made and supported.

(vii) All cargo tank lids, tank washing openings, ullage openings, sighting ports and vent pipes, except those in the tank(s) first to be cleaned, are closed.

(viii) All cargo lines which are not to be used are isolated, if possible, and appropriate valves closed.

(ix) The valves in a common vent system are properly isolated to prevent passage of flammable or harmful vapour back to a tank that has been processed.

(x) Scuppers are properly plugged, and spill pans or trays are in place beneath the manifold connections

(xi) Pump room precautions (see 5.3.4) are being observed and will continue to be observed throughout tank cleaning and gas-freeing. (Atmosphere Monitoring)

5.9.3 Tank washing

Making cargo spaces or other spaces free of flammable and/or harmful vapours and ensuring that they remain so will generally be most quickly accomplished by first stripping and washing out any residues of liquid.

(1) Washing with water or with water containing cleaning aids.

Water is the most common washing medium used either for flooding the bottoms of tanks, hosing or delivered through washing machines. The water may be added with a small amount of special material to improve the cleaning effect:

(i) They should be properly secured to the hose and lowered into the tank by a rope which is made fast on deck (machine washing at sea should not be started or should be stopped and the machine should be removed from the tanks if rolling if the ship is likely to cause the machine to strike against the steel structures).

(ii) Hoses supplied for use with tank washing machine should be tested periodically for electrical continuity.

(iii) Machines should be removed from tanks before disconnecting the hose from the hydrant.

(2) Washing with a solvent

Washing with a solvent or the cargo itself, may be required whether at the beginning of cleaning operations or finally to prepare the tank for the next cargo. Normally, such washing will involve flushing tank bottom through the cargo system and all precautions for handling the solvent should be observed. Unless the tank is inerted, washing through machines or hoses should not be permitted if the solvent generates static electricity and it or the residual cargo is flammable or the tank contains flammable vapour. If washing machines are to be used, the precautions under the preceding (1) should be observed.

(3) Steaming

Steam is a well-known generator of static electricity. It should never be injected into a tank until the tank has been washed to remove liquid and made free of flammable vapour. Steam should never be injected into a tank in which a washing machine is suspended unless the tank is free of flammable vapour. If steam has already been injected, no washing machine should be lowered into a tank if the steam is still visible.

(4) When heating coil or air duct opening, it consideration may not be possible to flow out that will remaining liquid and
vapour after tank cleaning and gas freeing.

5.9.4 Gas-freeing

(1) Tank opening in an enclosed space
As this ship has no tank opening in an enclosed space, there is not special care for this.

(2) Tank cleaning openings
To minimize the escape of the vapour, covers should be removed only from the tanks being gas-freed.

(3) Gas venting system
On a ship with a common venting, each tank should be isolated to prevent passage of flammable or harmful vapour back to a tank that has already been processed.

(4) Cofferdams or double bottoms
Leakage of liquid or vapour into cofferdams, etc. should be always suspected. The same precautions should be observed as when cleaning cargo tanks.

(5) Disposal of sludge, scale and sediment
Scale and sediment should not be left to build-up in a tank. A build-up may adversely affect stripping of cargo from tanks and gas-freeing and entrapped cargo may cause re-gasing. When removed from the tanks, sediment and scale should be kept wetted down to minimize release of vapour and the risk of spontaneous combustion only if the contents are non-reactive with water.

5.9.5 Testing of space for vapour

Gas-freeing equipment should be operated as long as it is necessary to ensure that the cargo tank or other space is sufficiently free of flammable and harmful vapours for the particular purpose. Appropriate gas indicators for the should always be used for testing the atmosphere in the space (see 5.2.7 of this manual). Adequate samples should be taken from separated points about the space to ensure that it is free of vapour throughout. It is important to remember that, depending upon its density, vapour may accumulate preferentially at the top or bottom of the space and also in locations where the flow of ventilating air is least.

5.9.6 Other precautions

(1) Tank cleaning after carriage of corrosives.
Tank washing should be disposed of as recommended in 5.9.3 of this manual. Tanks, pipelines, pumps and all associated equipment should be drained and washed thoroughly with a large volume of water. Apart from providing safe working conditions, complete removal of corrosive liquid is essential as any residue may cause serious corrosion accompanied by the formation of hydrogen. Prior to entry into enclosed spaces, the precautions set out in 7.3. of this manual should be observed.

(2) Tank cleaning after carriage of poisons.
Operations should be conducted only when wind conditions favour rapid dispersal of vapour and not be conducted in port. At sea the ship should be turned-off wind to prevent vapour entering accommodation. Preferably gas-freeing equipment should be of a that will enable the vapour to be expelled vertically upwards at a high velocity. Water alone should be used for tank washing unless it is known that cleaning aids such as caustic will not react with the poison. Tanks should not be washed by hand hose through open tank hatches.

(3) Tank cleaning with water after carriage of a chemical which reacts dangerously with water.
If a cargo tank has contained a chemical which reacts dangerously with water, tank cleaning with water should only be undertaken in the manner specified by the shipper or by some other safe means. If toxic vapours are evolved on conduct with water, then breathing apparatus may be required by those involved in the operation. See also the precautions concerning entry into compartments in 7.3. of this manual.

CHAPTER 6
SAFETY / EMERGENCY PRECAUTIONS
6.1 General

6.1.1 General precautions as general oil tankers

This ship intends to carry dangerous chemical as well as flammable products and other liquid products. For precautions of safety, there is no difference between general oil tanker and chemical tankers in principle, since general oil tankers intend to carry liquids with flammable hazards. Accordingly, precautions by safety / emergency for general oil tankers, provided on the ship, and there is no detail information for flammable hazard in this manual.

6.1.2 General precautions for chemical tankers

In this section are described general precautions for significant hazard other than normal fire hazards, such as significant fire hazards in excess of those of petroleum products, toxic hazards, reactivity hazards, etc.

Note: Precautions described in (1) to (8) are based on the text of “Safety in Chemical tankers”, published by ICS and they may be used as a general text for crews of chemical tankers.

6.1.2.1 Flammable and toxic vapours

Precautions for cargo vapours are not different from those of general oil tankers in principle. Chemical tankers may, however, have much hazards from cargo vapours than those of general oil tankers for their particular properties, such as wide range of vapour density, less allowable concentration for toxic vapour, etc. In this paragraph are shown precautions for cargo vapours of chemical tankers including those of general oil tankers.

(a) Presence of gas

There may be flammable or toxic gas;
after loading or unloading volatile or toxic cargo,
after loading any cargo into a tank which is not gas-free.

(b) Gas - free

The spaces in which gas-freeing operation was conducted and gas-free was ensured are not always of gas-free. Frequent tests are advisable.

There may be flammable or toxic gas;

(i) if flaking tank coating material is disturbed,
(ii) after heating coil is opened up,
(iii) when a pipeline or valve is opened up,
(iv) when a cargo went line is opened up,
(v) whenever cargo residue is presented particularly when it has been disturbed, e.g. behind tank coating blisters or imperfections.

(c) In other spaces

Flammable or toxic gas may be in a space into which flammable or toxic cargo may have leaked. Examples are;

(i) pump rooms
(ii) cofferdams
(iii) ballast tanks
(iv) double bottom tanks
(v) void spaces adjacent to the cargo tanks intended to carry these cargoes.

(d) Precautions at gas detecting

(i) Before opening a tank, any pressures must be relieved by the required procedures.
(ii) Openings must be closed as soon as possible.
(iii) A space which is shown by test instrument to be free of flammable or toxic gas is stated to be gas free.
(iv) Test for the presence of flammable or toxic gas must be carried out by a responsible officer.
(v) Chemical tanker must carry the instruments which are able to indicate;
- the presence of gas given off by the various toxic cargoes.
- the presence of flammable gas given off by volatile cargoes
- the presence of oxygen in the air.
- the presence of oxygen in the air.
(vi) Remember that the spaces adjacent to the cargo tanks and the cargo pumps rooms may contain;
- toxic / flammable gas
- air without enough oxygen to support life.

### 6.1.2.2 Dispersion

Many vapours are heavier than air. After they escape from tank openings or vents during loading, they will tend to lie around the decks. They are drawn into machinery spaces and air conditioning intakes. Winds moving at about 5 miles per hour (2.2 m/sec.) or less cause little air movement. Little air movement means great danger. Flammable or toxic mixtures may not disperse, They may lie at some distance from the place they arise. Quite rich concentrations can, however, be dispersed by quite gentle breezes complete and rapid dispersion requires a clear patch for the air.

(b) Eddies

If you watch a river flowing past the support for a bridge, you will see currents swirling behind the supports on the downstream side. Moving air behaves in the same way. Air flowing swiftly past the superstructure swirls around it. This happens especially on the lee side.

The passing air causes a slight drop in pressure.

Some of the moving air is drawn in the swirling current.

These currents are known as eddy currents.

During cargo operations a wind blowing may;
- contain flammable or toxic vapour
- form eddies containing flammable or toxic vapours
- deposit flammable or toxic gas near the superstructures.

(c) Precautions for dispersion and invasion of cargo vapours

Vapour must be excluded from galleys. If this cannot be done, electric galley equipment must not be used.

Vapour must be excluded from machinery spaces. Flammable gases must be kept from all sources of ignition in machinery spaces. Generally, during cargo operations, auxiliary machinery will be in use on the ship. In certain weather conditions (e.g. if there is fog and no breeze) it may not be possible to guarantee that vapour will not enter the machinery spaces. In these circumstances, cargo work must be stopped until the weather conditions change. Whenever large amounts of vapour accumulate around the deck, cargo work must be suspended.

During cargo operations or whenever dangerous vapour may be present around the decks;
- Strictly obey orders regarding closing doors and ports.
- Strictly carry out orders regarding ventilation and air intakes.
- Keep all windows and ports closed.

(d) Precautions for eddy current

(i) Eddy current forms depending upon wind force and wind direction.
(ii) A wind blowing from forward to aft may help vapour to accumulate aft of any superstructure in its path.
(iii) A wind blowing the ship will tend to deposit gas on the lee side.

### 6.1.2.3 Precautions for pollution

a) Spillage

Cargo spilled can be dangerous. It can often evaporate quickly.

- Toxic vapours may be released in large quantities
- Flammable mixture may form rapidly. The sea and air may become polluted.

b) Hose and connection
Defective hoses cause spillage, and defective or badly made connections are dangerous. Sudden strain on hoses causes the hoses and connections to be defective. Poor maintenance causes cargo gears to be defective, so always check the cargo gears for defect before they are used. Report any defect and leakage to the responsible officer.

c) Pollution
Of course, pollution is not a personal hazard, or a source of risk to the ship. But, in fact, it is a very real threat to the lives and livelihood of all of us. Even relatively small quantities of some chemicals discharged into the sea—particularly in coastal waters—have a terrible effect on human and marine lives in the sea. Life may have started in the ocean - Do not let it end there.

d) To prevent pollution due to cargo hoses
(i) Do not use hoses which appear defective.
(ii) Avoid bending flexible hoses excessively.
(iii) Hoses should be suspended from suitable equipment.
(iv) Hoses should never be allowed to chafe.
(v) Great care should be taken to avoid straining or breaking the hoses or connections when mooring a chemical tanker.
(vi) Should a cargo connection leak, report it immediately to the officer in charge who will effect remedial action. Never attempt to stop cargo operations to close any valve in the loading system and to operate any shut-off device at one’s own will.
(vii) During loading and unloading, all scuppers must be securely plugged and regularly check must be kept for signs of leakage.

6.1.2.4 Corrosive cargoes

(a) Corrosive cargo liquids have three special properties which concern us:

(i) Corrosive liquids destroy the human tissue in the body, causing serious damage that may be permanent.
(ii) They corrode the cargo tank construction materials, pipes, pump, etc. which are used for their safe containment.
(iii) Corrosive liquids can become flammable gases when in contact with some materials such as metal or fibrous materials.
   
   Metal + Corrosive liquid = Hydrogen gas
   Fibrous material + corrosive liquid = Fire

(b) Precautions for corrosive cargoes:

(i) All materials used in the construction of the tanks and cargo system must be resistant to corrosion.
(ii) While these cargoes are being handled as a duty, wear full protective clothing as instructed by the officer in charge. All parts of the body, specially the eyes, must be covered.
(iii) Great must be taken when opening up a tank, space, valve, line or blank.
(iv) Materials such as cotton waste must not be used for mopping up corrosive liquids. Corrosive liquids, waste, etc., will cause fire.
(v) If a person is splashed with corrosive liquid, remove the clothes and wash them with plenty of water. Showers are available on deck for this purpose.
(vi) Report all accidents to the officer in charge.

6.1.2.5 Poisonous and toxic cargoes

(a) Fire is the best known danger in the tankers.

In chemical tankers, apart from the fire hazard, some cargoes may be toxic or poisonous. Toxicity is the ability of a substance to harm a person if it reaches a sensitivity part of body.
A substance can do even more damage to person, although both poisonous and toxic substances can KILL.

Some toxic cargoes will harm person if they are inhaled.

They may:

i) dull the sense of smell  
ii) make person dizzy  
iii) produce a diminished sense of responsibility  
iv) give a headache  
v) irritate eyes  
vi) cause staggering and confusion (appearance of drunkenness)  
vii) cause loss of consciousness  
viii) cause breathing to stop  
ix) cause death

Inhalation of some toxic vapours may lead to:

x) brain damage  
xi) damage to nervous system  
xii) damage to the liver and other vital organs  
xiii) death

(b) Precautions for poisonous and toxic cargoes

As cargo enters the tank, vapours vented to the atmosphere through the venting system. This is known as closed loading. Some cargoes, because of unusually high toxic hazard or objectionable odour, may require the vapour to be returned ashore. This is done through a hose connected to the gas line and called a vapour return connection.

When disconnecting hoses used for handling toxic or poisonous cargoes:

(i) Wait for instructions from the officer in charge  
(ii) Wear protective clothing and breathing apparatus  
(iii) Make sure the hose is properly drained before starting to disconnect.

Before disconnecting, open the test cock to make sure the line is not under pressure.

6.1.2.6 More about toxic and poisonous cargoes

(a) Some toxic or poisonous cargoes which are dangerous when they are absorbed into the body through the skin.

(i) irritation of the skin  
(ii) dermatitis  
(iii) skin cancer  
(iv) blood poisoning  
(v) damage to the vital organs  
(vi) death

When handling toxic or poisonous cargoes;

(i) avoid all possibility of skin contacting the cargoes  
(ii) wear protective clothing as instructed by the officer  
(iii) carefully follow the instructions of the officer

When contacting with a cargo of this type:

(i) remove all affected clothing  
(ii) wash the affected area with large quantity of water  
(iii) inform the officer of the watch  
(iv) get medical advice

(b) Toxic cargoes will harm person when they are swallowed, leading to damage to many parts of the body and possibly to death.

When handling these products:

(i) keep hands away from mouth and face
(ii) never allow clothing to come into contact with mouth
(iii) wash thoroughly before going off duty or before taking a meal.

(c) When toxic or poisonous cargoes are being loaded or unloaded through a pump room system;

(i) the pump room ventilation must be started at least 15 minutes before the operation begins.
(ii) the pump room ventilation must be kept running throughout the operation
(iii) such cargoes must not be allowed to accumulate in the pump room bilge.
(iv) frequent checks must be made on the pump room atmosphere
(v) if there are any leaks the cargo operation must be stopped at once
(vi) pumps should be controlled, as far as possible, from outside the pump room
(vii) never enter the pump room unless it is essential
(viii) never enter the pump room without the instruction from the officer in charge. In this case follow his instruction regarding clothing and breathing apparatus.

(6-a) Liquid petroleum

(a) Ingestion

The risk of swallowing significant quantities of liquid petroleum during normal tanker and terminal operations is very slight. Petroleum has low oral toxicity to man, but when swallowed it causes acute discomfort and nausea. There is then a possibility that liquid petroleum may be drawn into the lungs during vomiting and this can have serious consequences, especially with higher volatility products such as gasolines and kerosenes.

(b) Skin Contact

Many petroleum products, especially the more volatile ones, cause skin irritation and remove essential oils from the skin, leading to dermatitis. They are also irritating to the eyes. Certain heavier oils can cause serious skin disorders on repeated and prolonged contact.

Direct contact with petroleum should always be avoided by wearing the appropriate protective equipment, especially impervious gloves and goggles.

(6-b) Petroleum Gases

The main effect of petroleum gas on personnel is to produce narcosis. The symptoms include headache and eye irritation, with diminished responsibility and dizziness similar to drunkenness at high concentrations these lead to paralysis, insensibility and death.

The toxicity of petroleum gases can vary widely depending on the major hydrocarbon constituents of the gasses. Toxicity can greatly influenced by the presence of some minor components such as aromatic hydrocarbons (e.g. benzene) and hydrogen sulphide. A TLV of 300 ppm, corresponding to about %2 LFL, is established for gasoline vapors. Such a figure may be used as a general guide for petroleum gases but not be taken as applicable to gas mixtures containing benzene or hydrogen sulphide.

The human body can tolerate concentration somewhat greater than the TLV for short periods. The following are typical effects at higher concentrations:

<table>
<thead>
<tr>
<th>Concentration</th>
<th>LEL</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>0,1% vol. (1000 ppm)</td>
<td>10%</td>
<td>Irritation of the eyes within one hour.</td>
</tr>
<tr>
<td>0,2% vol (2000 ppm)</td>
<td>20%</td>
<td>Irritation of the eyes, nose and throat, dizziness and unsteadiness within half an hour</td>
</tr>
<tr>
<td>0,7% vol (7000 ppm)</td>
<td>70%</td>
<td>Symptoms as of drunkenness within 15 minutes</td>
</tr>
<tr>
<td>1,0% vol (10000 ppm)</td>
<td>100%</td>
<td>Rapid onset of “drunkenness” which may lead to unconsciousness and death if exposure continues.</td>
</tr>
<tr>
<td>2,0% vol (20000 ppm)</td>
<td>200%</td>
<td>Paralysis and death occur very rapidly</td>
</tr>
</tbody>
</table>

The smell of petroleum gas mixtures is very variable, and in some cases the gasses may dull the sense of smell should therefore never be taken to indicate the absence of gas.

The TLV concentration is considerably below the lower flammable limit and combustible gas indicators cannot be expected to measure concentrations of this order accurately.

Above precautions be have to consider for GASOLINES CONTAINING TETRAETHYL LEAD AND TETRA METHYL LEAD.

(6-c) Hydrogen sulphide

Many crude oils come out of the well with high levels of hydrogen sulphide(H2S) but this level usually reduced by a stabilisation process before the crude oil is delivered tp the vessel. However, the amount of stabilisation may be temporarily reduced at times. Thus a tanker may receive a cargo with a hydrogen sulphide content higher than usual. In addition, some crude oils are never stabilised and always contain a high hydrogen sulphide level. Hydrogen sulphide can also be encountered in other cargoes such as naphta, fuel oil, bitumens and gas oils.
The Permissible Exposure Limit (PEL) of hydrogen sulphide expressed as a Time Weighted Average (TWA) are:

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>500-100 ppm</td>
<td>Eye and respiratory tract irritation after exposure of one hour.</td>
</tr>
<tr>
<td>200-300 ppm</td>
<td>Marked eye and respiratory tract irritation after exposure of one hour.</td>
</tr>
<tr>
<td>500-700 ppm</td>
<td>Dizziness, headache, nausea etc. within 15 minutes, loss of consciousness and possible death after 30-60 minutes exposure.</td>
</tr>
<tr>
<td>700-900 ppm</td>
<td>Rapid unconsciousness, death occurring a few minutes later.</td>
</tr>
<tr>
<td>1000-2000 ppm</td>
<td>Instantaneous collapse and cessation of breathing.</td>
</tr>
</tbody>
</table>

**Note:** Persons over exposed to H2S vapour should be removed to clean air as soon as possible. The adverse effects of H2S can be reversed and the probability of saving the person’s life improved if prompt action is taken.

**Vapour Monitoring:**

- Exposure of personnel to hydrogen sulphide should be monitored by using suitable instrumentation for detecting and measuring the concentration of the gas.
- Spot checks on vapour concentrations can be carried out by ship’s personnel to verify that vapour levels are not being exceeded, particularly during such operations as gauging and sampling for custody transfer, connection and disconnection of pipe lines and mopping up spills. These spot checks are carried out using detector tubes.

**Personnel protective equipment (PPE)**

- Procedure should be defined for the use of respiratory protective equipment, when concentrations of vapour are detected by the vapour monitoring equipment. This should be implemented on a phased basis depending on the equipment available on the ship and the concentration of vapour detected.
- Consideration should be given to providing Emergency Escape Breathing Apparatus to personnel working in hazardous areas. These are very portable and can be donned quickly if gas is detected.

* These precautions should also be observed during ballasting, tank cleaning and gas freeing operations associated with the carriage of cargoes with a hydrogen sulphide content.

Personnel should be required to wear respiratory protective equipment under the following circumstances.

* When Permissible Exposure Limits specified by national or international authorities are exceeded.
* When monitoring cannot be carried out.
* When closed operations cannot be conducted for any reason and hydrogen sulphide concentrations could exceed Permissible Exposure Limits.

Prior to entry into a tank which has previously carried petroleum products containing hydrogen sulphide, the tank should initially be ventilated to a reading of not more than 1% LFL on a combustible gas indicator and then checked using the appropriate instruments to ensure that there are no detectable traces of hydrogen sulphide.

**6.1.2.7 Reactive cargoes**

(a) Reactive cargoes may;

(i) be self reactive
(ii) react with air
(iii) react in contact with another cargo
(iv) react with water

(b) Reaction may take a variety of forms and may;

(i) produce heat
(ii) release vapour
(iii) produce a rise in pressure in the tank
(iv) affect the cargo quality
(v) increase the danger of fire or explosion
(vi) increase the health hazard
(vii) polymerize (solidify)
(c) The possibility of reaction is removed in a variety of ways;

(i) Avoiding the contact with different cargoes during loading and/or stowage. This is necessary for avoiding high cost assurance and cargo damage due to miring with each other as well as avoiding the reaction among 2 or more dangerous chemicals.

(ii) The addition to the cargo of an INHIBITOR to render the cargo stable and safe. Inhibitor is a general term for a compound which, when added to the cargo, has the effect of slowing down or stopping a chemical change, i.e. polymerization, oxidation or corrosion.

(iii) The application of INERT GAS to the ullage space above the cargo in the tank. Inert gas will prevent the cargo coming into contact with the air. This is called applying an INERT GAS BLANKET or NITROJEN BLANKET over the top of the cargo.

(iv) Avoiding the use of certain metals and other materials in the cargo system with which the cargo might react.

(v) Stowing cargoes which may react with each other in the spaces separated by a cofferdam, pump room or void space, or stowing a harmless cargo between reactive cargoes.

(vi) Carrying water reactive cargoes in “double-skin” spaces.

(vii) Blanking off the heating coils in tanks carrying water reactive cargo.

(viii) Using oil as a heating medium for water reactive cargoes.

6.1.2.8 Benzene and other aromatic hydrocarbons (carcinogenic cargoes)

The aromatic hydrocarbons include benzene, toluene, and xylene. These substances are components in varying amounts, in many typical petroleum cargoes such as gasolines, gasoline blending components, reformats, naphtas, special boiling point solvents, turpentine substitute, white spirits and crude oil.

The health hazards of aromatic hydrocarbons are not fully established but it is recommended that personnel engaged in cargo operations involving products containing them follow the precautions and procedures described section measuring and sampling cargoes containing toxic substances in order to minimise exposure due to cargo handling operations.

The threshold limit value (TLV) or Permissible exposure limit (PEL) of an aromatic hydrocarbon vapour is generally less than other hydrocarbons.

Benzene:
Repeated over exposure to high levels of benzene vapour may have chronic effects which can lead to disorders of the blood and bone marrow. Personnel engaged in operations involving the products containing benzene should therefore follow the precautions described in section 6 in order to minimise exposure during cargo operations.

Benzene primarily presents an inhalation hazard. It has poor warning qualities, as its odour threshold is well above the permissible exposure limit.

Exposure to concentrations in excess of 1000 ppm can lead to unconsciousness and even death. Benzene can also be absorbed through the skin and is toxic if ingested.

Cargo containing benzene should be handled using the closed operation as this will significantly reduce exposure to benzene vapour.

Crew should adopt procedures to verify the effectiveness of the closed loading system in reducing the concentration of benzene vapours around the working deck.

This will involve surveys to determine the potential exposure of personnel to benzene vapour during all operations such as loading, discharging, sampling, hose handling, tank cleaning, venting or ballasting tanks whose previous cargo contained benzene.

Spot checks on vapour concentrations using detector tubes and pumps can be carried out by ship’s personnel to ascertain if vapour level are being exceeded and if personal protective equipment may need to be worn.

Personnel protective equipment (PPE):

Master and crew have to be familiarized for use of respiratory protective equipment where personnel are at risk of being exposed to benzene vapours in excess of permissible exposure limits (PEL).

Personnel should be required to wear respiratory protective equipment under the following circumstances:

* When PEL’s specified by national or international authorities are exceeded
* When monitoring cannot be carried out.
* When closed operations cannot be conducted for any reason

The need to use respiratory protective equipment may extend to those personnel not directly involved in cargo operations.

Tank entry:
Prior to entry into a tank which has recently carried petroleum products containing benzene, the tank should initially be ventilated to a reading of not more than 1% LFL on a combustible gas indicator and then checked using the appropriate instruments to ensure that the concentration of benzene vapours do not exceed permissible exposure limits.

6.1.2.9 Inert gas

Inert gas is principally used to control cargo tank atmospheres and so prevent the formation of flammable mixtures. The primary requirement for an inert gas is low oxygen contents. Most using equipment on fleet ship’s is nitrogen generator. Main hazard from nitrogen inerting that this gas has not any odour or color can’t easily recognize.

The oxygen content of the atmosphere in enclosed spaces may be low several reasons. The inerting is common and planned action on vessel operations. As the amount of available oxygen decreases below the normal 21% by volume breathing tends to become faster and deeper. Symptoms indicating that an atmosphere is deficient in oxygen may give inadequate notice of danger. Most persons would fail to recognise the danger until they were too weak to be able to escape without help. This is especially so when escape involves the exertion of climbing.

While individuals vary in susceptibility, all will suffer impairment if the oxygen level falls to 16% by volume.

Exposure to an atmosphere containing less than 10% oxygen content by volume inevitably causes unconsciousness. The rapidity of onset of unconsciousness increases as the availability of oxygen diminishes, and death will result unless the victim is removed to the open air and resuscitated.

An atmosphere containing less than 5% oxygen by volume causes immediate unconsciousness with no warning other than a grasp for air. If resuscitation is delayed for more than a few minutes, irreversible damage is done to the brain even if life is subsequently restored.

Entry into oxygen deficient spaces must never be permitted without breathing apparatus until such spaces have been thoroughly ventilated and test readings indicate an oxygen level of 21% by volume throughout.

6.1.2.10 Vegetable and animal oils

Some cargoes to be carried will be oils or fats manufactured from vegetable or animal sources. These are called Animal Oils or Vegetable Oils. These oils are generally entirely safe, but they can have a tendency to oxidize - that is, they will absorb oxygen from the air and the air remaining in a tank containing vegetable or animal oil or coated with residual quantities of these oils, may not have enough oxygen in it to support life.

Before entering a tank or space containing any remains of animal or vegetable oil;

(i) obtain the permission of the officer on duty
(ii) measure the oxygen content of the air and make sure that it is normal (normal air which we breathe contains 21% oxygen). Atmospheres showing an oxygen level of less than 16.5% are unsafe.

Remember:

An explosive meter (combustible gas indicator) will not indicate oxygen levels.

While in the tank or space;

(i) carry out frequent test to make sure that the amount of oxygen in the air is not decreasing.
(ii) arrange somebody at the tank hatch on deck so that he can give the alarm in the event of emergency.

6.1.3 Guideline of access within cargo tank area

When entering in to a space within the cargo tank area, care should be taken to the precautions mentioned in 7.3. of this manual.

6.1.4 List of general documents

Certificate, letter of compliance, regulation, form of letters to submit to Administration involved, reference book, etc. which are concerned with operation of the ship as a chemical tanker are provided on board as follows:

1. Certificate of Fitness of the IMO Chemical Code,
2. Classification certificate,
3. File of catalogues and instruction booklets of equipment, machinery, apparatuses, etc.
4. IMO Resolution A212 (VII) “Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals
in Bulk “.
(5) Stability information
(6) Calculation of trim and stability
(7) Loading manual
(8) Damage stability calculation (prepared by the Honda Shipyard Co.)
(9) Medical first aid guide for use in accidents involving dangerous goods (published on behalf of IMO, WHO & ILO).

CHAPTER 7

SAFETY PRACTICES ON BOARD

7.1 FIRE:
Class A:

Fires involving solid materials normally of an organic nature, in which combustion generally occurs with the formation of glowing members. Typical examples are wood, paper, cloth and some plastics.

CLASS B:

Fires involving liquids which produce flammable vapours such as paints, oils and spirits, and includes liquifiable solids such as fats and waxes.

CLASS C:

Fires involving liquefied gases and not likely to be encountered in the fleet. Certain chemicals are included in this class of fire and many of these give off highly toxic products of combustion.

CLASS D:

Fires involving metals. Sodium, potassium and magnesium are ignitable and burn vigorously.

Electrical fires do not constitute a class since any fire involving, or started by electrical equipment must be class A, B or D.

**FLAMMABILITY**:

The main factors which determine flammability are:

Flammable range: Is the range between the upper and lower flammable (or explosive) limits usually expressed as UFL (or UEL) and LFL (or LEL). Below the LFL, the mixture of cargo and air is too weak to burn, and above the UFL there is insufficient air present to support combustion.

Volatility or vapour pressure: is the tendency of a liquid to vaporise or give off gas. It is usually expressed in terms of Reid Vapour Pressure (RVP).

Flash point: is the lowest temperature at which sufficient vapour is being given off for there to be a momentary flash on the application of a naked flame or spark.

Ignition Temperature: Sometimes known as a fire point, may be defined as the lowest temperature at which heat from the combustion of a burning vapour is capable of producing sufficient vapour is capable of producing sufficient vapour to enable combustion to continue after the source of ignition is removed.

Self ignition temperature: sometimes referred to as spontaneous ignition temperature at which a substance will ignite without the introduction of an external ignition source.

The following are some examples of flash point and self ignition temperature:

<table>
<thead>
<tr>
<th>Substances</th>
<th>flash point</th>
<th>self ignition temp.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Methane</td>
<td>-175 deg. cel.</td>
<td>536 deg. cel.</td>
</tr>
<tr>
<td>Fuel oil</td>
<td>90 deg. cel.</td>
<td>255 deg. cel.</td>
</tr>
<tr>
<td>Wood</td>
<td>232 deg. cel.</td>
<td></td>
</tr>
</tbody>
</table>

The following temperatures have been included for purposes of compression:

- Match flame: 900/1100 deg. cel.
- Cigarette: 600 deg. cel.
- 60 Watt open light bulb: 120 deg. cel.
EXTINGUISHMENT:

The principles of fire extinguishment can be most easily understood by referring to the Fire Triangle.

OXYGEN                  HEAT                  CARGO

OXYGEN: of which there is an adequate supply in the surrounding air, HEAT, in the form of an ignition source, and CARGO, which can be any combustible material.

1-Removal of heat by cooling to below the flash point of the substances.

2-reduction of oxygen.

3-Removal of cargo

REMOVAL OF HEAT:

Water is the most effective and most readily available medium for extinguishing fires of a general nature and particularly those involving class A materials.

The high thermal capacity of water and the latent heat of vaporisation produce the cooling effect. The later is far the more important factor as it takes several more times as much heat to convert a certain weight of water at its boiling point into steam as is required to raise the same amount of water from its normal temperature to its boiling point. Water is most efficient when applied in the form a spray of water fog.

REDUCTION OF OXYGEN:

Methods vary from the application of CO2 or other inert gas or of foam, in the case of liquid fires to simply cutting off the air supply by smothering with a fire blanket or other suitable means.

DRY POWDER:

General purpose dry powder extinguisher are effective in extinguishing both class A and B fires and are particularly useful where electrical equipment or circuits are present.

The action of dry powder is to chemically inhibit flame propagation.

Dry powder extinguisher should be used with “sweeping” motions over the flame area.

Dry powder possesses no cooling properties and precautions must be taken against re-ignition until the fire area has cooled.

FOAM:

The methods by which foam extinguisher a liquid fuel fire have not yet been completely defined. There are number of contributory factors. The most important being:

--Interception of the radiant heat from the flames preventing it reach in the fuel surface and evaporating further cargo.

--Formation of a sealing blanket over the cargo surface to prevent vapour escaping.

--Cooling of the cargo.

--Isolation of the cargo from the oxygen of the air.

--Dilution of the air with water vapour from the evaporated foam.

Various factors relating to foams will influence their performance - these relate to their properties, application rates and methods of application. Normally in tankers and chemical ship conventional foam with an expansion rate of from 8-1 to 12-1 may be used for deck and cargo area coverage.

"Light Water" or aqueous film forming foam is a synthetic foam forming liquid which acts as a very effective smothering agent. It also possesses excellent penetrating and wetting qualities which makes it suitable for both class A and B fires.
### CLASS OF FIRE

<table>
<thead>
<tr>
<th>RISK</th>
<th>WATER</th>
<th>FOAM</th>
<th>AFFF</th>
<th>CO2</th>
<th>C.PWDR</th>
<th>HALON</th>
</tr>
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<tbody>
<tr>
<td>A</td>
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<td>*</td>
<td></td>
<td></td>
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<tr>
<td>Paper, wood etc.</td>
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<tr>
<td>B</td>
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<tr>
<td>Flammable liquids</td>
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<td>C</td>
<td></td>
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<tr>
<td>Flammable gas</td>
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<tr>
<td>D</td>
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<tr>
<td>Metals</td>
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<td>E</td>
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<td>*</td>
<td>*</td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>Electrical Hazards</td>
<td></td>
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</tbody>
</table>

- * SUITABLE
- ** BEST

### 7.2 FIRE PREVENTION

#### 7.2.1 General:

Fire is the single greatest cause of serious casualties to ships and lives lost at sea. The majority of recorded incidents of fire at sea would not have occurred had proper precautions been taken.

It is the responsibility of every person on board to exercise due care and to comply with regulations. Fire prevention is mainly a matter of using one's intelligence and developing safety awareness.

**PREVENTION IS BETTER THAN CURE**

#### 7.2.2 Smoking

Smoking in bad and the careless discarding of smoking materials is prohibited at all times. The following apply to all ships:
AT SEA: smoking is prohibited at the discretion of the master and will be restricted to cabins and messrooms, the wheelhouse and the engine control room/position. Under no circumstances will smoking or the carriage of matches/lighters be permitted anywhere on open decks, or in pumprooms, store rooms or paint rooms, even when the vessel is gas free. Smoking in accommodation alleyways should not be permitted.

IN PORT: smoking will be subject to terminal regulations. In the absence of such regulations smoking will be restricted to one designated room for officers and one for crew, in the after part of the ship. This regulation will also apply during ship/shipping or ship/barge operations or when at cargo buoy moorings.

7.2.3 Hot Work:

Hot work includes welding and burning and the use of blow torches.

It must always be remembered that when hot work is being carried out heat may be conducted through a bulkhead and start a fire on other side. An efficient fire watch on both sides is therefore essential.

7.2.4 Funnel Sparks:

Sparks or hot soot from the funnel or from the funnel of a nearby ship may act as a source of ignition and where this danger is apparent, cargo, tank cleaning or gas freeing operations must be stopped and any openings, including pumproom doors, closed.

The risk can be reduced by blowing boiler tubes shortly before arrival at a port. However, engineers should always request permission from the bridge watchkeeping officer before commencing this operation.

7.2.5 Current Electricity:

Most electric equipment, unless certified flameproof or intrinsically safe, is capable of producing sparks of sufficient intensity to ignite a flammable gas.

As most of the electrical equipment and fittings within the accommodations and galley are not of the intrinsically safe type, it is important to keep flammable vapours out of the these areas.

Unless certified gas free, the use of non-intrinsically safe electrical equipment will generally include:

--- wandering electric leads
--- portable electric lamps (unless certified safe)
--- non-approved torches and hand lamps
--- transistor radios, recorders, etc.
--- walkie-talkie radios (unless certified safe)
--- electrically operated cameras and flash guns
--- ungrounded radio antenna

Gas tight light fittings must be inspected regularly for cracked glasses, frayed cables or other signs of damage. If damaged, they must be first isolated electrically and then repaired.

A regular weekly inspection must also be made of electric motors, equipment and fittings within the accommodation, store rooms, engine room.

7.2.6 Friction:

The overheating of machinery bearings and seals can cause fires in machinery spaces or pump room etc.

Overgreasing can often be as dangerous as insufficient grease and the equipment manufacturers recommendations should always be observed.

7.2.7 Spontaneous Combustion:

Damp or oil-impregnated organic material such as rags, cotton waste or sawdust may oxidise and produce heat resulting in spontaneous combustion.
Such materials must be kept dry and stored away from oil and greases.

Waste and soiled material must never be allowed to accumulate. It should be disposed of safely on completion of the work and certainly at the end of the day.

### 7.2.8 Safe Housekeeping

General tidiness and good housekeeping are essential aspects of fire prevention. Accumulations of rubbish such as packing material and shavings, full waste paper baskets, and ash trays containing paper are common examples of potential fire hazards.

### 7.2.9 Galley Fires:

The most common types of galley fires are caused by the heating of oils and fats to their self-ignition temperatures. Serious fires have occurred as a result of ignition of cooking oil in deep fryers and these must never be left unattended.

Accumulation of grease and oil on the surfaces of stoves, on ventilator grills and in uptake trunkings not only present a risk of self-ignition but can cause a fire to spread rapidly. These surfaces must be cleaned frequently.

### 7.2.10 Paint Stores:

Most paints contain high levels of solvents and other volatile materials. If paint drums are left unsealed or become damaged, flammable vapours can readily accumulate.

Particular attention must be paid to the condition of the flame proof electrical fittings. Smoking or the carriage of smoking materials into paint stores is prohibited.

### 7.2.11 Oxygen And Acetylene Cylinders:

Oxygen and Acetylene cylinders must be stowed in the special lockers provided. Care must be taken to ensure that the cylinders and fittings in these lockers are kept free of oil and grease at all times.

### 7.2.12 Fire Prevention - Machinery Spaces:

The engine room is the area of greatest fire risk in any type of ship and a high level of safety awareness is required of all engine room personnel.

Fire prevention measures will include the following:

--Good housekeeping
--Smoking is prohibited except in the control room and workshops.
--Frequent inspection of the machinery spaces for the purpose of removing fire hazards.
--Correct maintains of machinery and fire fighting equipment.
--Keeping bilge clean and free from oil and water.
--Keeping spaces well ventilated.

### 7.2.13 Fire Prevention - Accommodation, Storerooms And Galley:

An accommodation fire will involve class A material (fibrous material).

Smoking regulations must be made known to every member of the ship's crew.

Smoking in bed is prohibited at all times regardless of the type of the ship.

Regular inspections should be made to ensure that electrical fittings are safe. The removal of the light glasses or the shading of electric light bulbs is dangerous and is forbidden.

The deck officer of the watch is to make rounds of the accommodation and outside the storerooms to check against the possibility of an undetected outbreak of fire after the 4 to 8, 8 to 12 and 12 to 4 night watches. During these rounds, the officer is to inspect drying rooms to ensure that no clothing is in contact with heaters.
The chief cook/steward is responsible for ensuring that the galley stove and other electrical appliances are switched off before the galley is vacated. He will also ensure that the stoves, hot-plates and ventilation exhausts are kept free from accumulations of fat and grease all times.

Electric lights and appliances must not be left switched on in unattended spaces.

7.2.14 Additional Precautions For Tankers:

ELECTRICAL STORMS:

A number of serious fires and explosions have occurred as a result of lightning striking ships and igniting cargo vapours. Cargo, tank cleaning and gas freeing operations must be suspended when electrical storms are in the vicinity. All openings to cargo tanks must be securely closed and cargo tank vent by-pass valves closed.

INPACT SPARKS:

The risk of ignition of petroleum vapours from impact sparks created by hand tools is only slight, however an incendive spark can be produced by impurities, such as sand or grit, being present between the impacting surfaces. Tools made of non-ferrous materials such as phosphor bronze can create dangerous sparks because, due to the softness of the alloy, foreign particles become readily imbedded. Use of such tools is prohibited.

Power tools such as pneumatic scaling hammers and wire brushes will, because of the high energy output, create sparks of sufficient intensity to ignite flammable vapours. Aluminium, magnesium and their alloys will readily produce sparks of high intensity if struck by or against steel. These sparks are known as "thermite" sparks and will readily ignite flammable vapours.

Thermite sparks can also be produced if rust smeared with the aluminium, or even aluminium based paints, are struck. For this reason, care must be taken to avoid dragging aluminium fittings such as gangways across steel decks. Similarly, the use of aluminium based paints is prohibited anywhere outside of the engine room in tankers.

7.3 ENTRY INTO ENCLOSED SPACES

7.3.1 General:

It is of the utmost importance that the precautions applying to entry into enclosed spaces are understood by every member of the crew.

Enclosed spaces include cargo tanks and holds, ballast tanks void spaces, peak tanks, cofferdams, duct keels, bunker tanks, fresh water tanks and any spaces that are normally kept closed. If in doubt, a compartment should be regarded as an enclosed space.

7.3.2 Oxygen Deficiency:

Lack of oxygen should always be suspected in tanks and other compartments that have been closed for some time, particularly if they have been contained water or have been subjected to dump or humid conditions.

Low levels of oxygen may also exist in cargo holds of bulk carriers as a result of oxidation processes in the cargo. Iron ore, particularly if damp, coal grain and tapioca have all been known to consume oxygen in the atmosphere or to displace it by the evaluation of other gases.

7.3.3 Gas Tests For Entry:

No entry will be permitted into any enclosed space unless the atmosphere inside has been tested and found to contain sufficient oxygen and is free of toxic gases where applicable.

The first test in all ships will be to ensure that the atmosphere throughout the space contains 21% oxygen by volume as determined by representative samples with a properly calibrated oxygen meter.

The second test, applicable to tankers, will be to ensure that no hydrocarbon gases are present and zero readings on a properly calibrated explosivemeter must be obtained throughout.

In product and chemical tankers further tests will be required to ensure that the space to be entered is free of toxic gases. These tests will be made with chemical tube detectors or other instruments calibrated for specific gases.
7.3.4 Ventilation:

Ventilation must be carried out before entry is permitted into any enclosed space. If forced ventilation is used at least two air changes must take place before entry is allowed. Where only natural ventilation is possible the space must be allowed to "breathe" for at least 24 hours. In certain spaces, such as double bottom tanks, the most effective way of ensuring full ventilation may be to fill the compartment with clean sea water and then pump it out allowing fresh air to be drawn in. Regardless of the method employed entry will be allowed until tests have shown that a safe, breathable atmosphere exists. Pumprooms and duct keels in tankers, and bulk carriers are provided with fixed ventilation systems which must be in operation for at least 15 minutes before any entry is permitted.

7.3.5 Entry Procedures:

No one may enter an enclosed space without the permission of the officer in charge who will first ensure that the necessary tests have been completed and that the requirements of the ENCLOSED SPACES ENTRY CHECK LIST are complied with in full. Normally not more than one senior officer from any department will enter an enclosed space at one time.

7.3.6 Enclosed Space Entry Check List:

The check list will be completed by the officer in charge of entry and approved by the master. A separate check list will be completed for each entry operation. An example of the "Enclosed space entry check list" is shown at the end of this chapter.

7.3.7 Cargo Pumprooms:

Entry into cargo pumprooms in tankers is a normal operational requirement during cargo, ballasting or tank cleaning. The following precautions will however be observed:

--Ventilation must have been operating at least 15 min. and remain in operation.
--The officer on watch or another responsible person must always be informed before a person enters a pumproom and immediately on returning to the deck.
--A check of the atmosphere at the lower levels must be made with a properly calibrated explosivemeter.

Pumproom bilges must always be kept clean and dry. A permanently rigged lifeline and rescue harness will be maintained at the top of each pumproom.

7.3.8 Entry Into Non-Gas Free Spaces:

Entry into a space that is not gas free or does not contain 21% oxygen will only be permitted if there is no alternative and such cases will be regarded as an emergency. The number of persons entering will be kept to a minimum but will normally be at least two, and each will wear either a compressed air breathing apparatus or a compressed air breathing apparatus with external air supply connected to the belt manifold. Under these circumstances entry will be considered an emergency and a rescue team fully equipped with breathing apparatus and with rescue equipment will be standing by.

7.3.9 Canister Respirators:

This equipment affords no protection against shortage of oxygen and provides limited protection against toxic gases.

7.4 HOT WORK PROCEDURES

7.4.1 GENERAL:

Hot work repairs to ships in service have been the cause of a number of major fires and explosions often resulting in loss of life or serious injury and in several instances leading to the total loss of the ship. The safe conduct of hot work repairs while in operational service is feasible provided that potential hazards are clearly defined, specific instructions issued, and the operation is controlled and monitored by a responsible person on board.
7.4.2 HAZARD APPRECIATION:

In tankers, cargo and ballast tanks, void spaces, duct keels and pipelines must always be considered to contain residual pockets of hydrocarbon gas. Explosion hazard may also be present in bulk carriers. The relatively high incidence of explosion in coal carriers serves as an example of this. Certain potential hazards are present in all ships and will require particular precautions to be taken. Serious fire and explosions have resulted from:

---hot work in the vicinity of fuel tanks.
---conduction of heat through steel from safe to unsafe areas
---ignition of flammable materials of all types
---ignition of flammable vapours in paint stores

7.4.3 GENERAL RESTRICTIONS:

Management approval must be obtained before any hot work is permitted outside the engine room/accommodation block in a chemical tanker unless the ship has been fully gas freed. Similar restrictions should be applied to coal loaded bulk carriers except that hot work on the open decks 10 meters or more abaft the bridge front bulkhead is permitted provided that cargo hatches are sealed and a breeze is blowing across the decks.

No hot work is permitted anywhere in a tanker during the loading or discharging of cargoes, during ballasting, tank cleaning or gas freeing, or when the ship is alongside terminal or tank cleaning berth.

7.4.4 RESPONSIBILITIES:

The responsibility for ensuring that hot work is conducted safely rests with the master. He will personally ensure that the correct procedures are understood and followed by all concerned. The chief officer will normally be responsible to the master for executing the necessary tests and procedures. When work is being carried out over a period of days, the person in charge of the hot work must obtain the chief officer's permission before each daily commencement and must report to him on the completion of each day's work.

Hot work within the machinery spaces will be subject to the approval of the chief engineer who will personally satisfy himself that all necessary safety precautions are being observed.

Good liaison between departments is necessary, to ensure that all relevant personnel are aware of the hot work in progress and that no hazardous situations develop.

7.4.5 SPECIAL PRECAUTIONS:

The following precautions must be observed on every occasion when hot work is intended.
1-Fire fighting equipment laid out ready for use. If welding or cutting on compartment boundary, equipment to be in readiness on both sides.
2-Fire watchmen to be posted and briefed in their duties. Walkie-Talkie link to be set up
3-Area to be checked for cleanliness. All combustible material to be cleared from area. (Both sides of boundary where applicable.)
4-Check that area and adjacent compartments and tanks are gas free. (Explosivemeter reading not exceed 1% L.E.L.)
5-Emergency plan drawn up and discussed.

7.4.6 HOT WORK PERMIT CHECK LIST

7.5 TOXICOLGY SAFE PRACTICES ON BOARD PERSONAL PROTECTION

POISONING AND OTHER RISK WITH CARGO CONTACT

Different chemicals effect the human body in many different ways. The subject is comprehensive and a deeper insight into this is beyond the scope of this book. A general information and some practical advice will be given. The definition of poisonous and classification of poisons is not uniform throughout the world. We can define a poison as a substance which is harmful to human beings (or environment). In the IMCO Code ref(25) a substance is classified as a poison if there is a risk of death or serious bodily harm after oral intake, inhalation or skin contact.

The poisonousness of a substance is usually expressed in term of LD50-values, Lethal Dose (Sometimes LC50, Lethal Concentration). This values are determined by tests with animals and give the dose, expressed in mg/kg body weight which kills...
Certain chemicals may cause sensitizing upon first contact. Later contacts with the same chemical, even at lower benzene causes reduced consciousness in acute poisoning but causes blood and bone marrow damage in chronic poisoning. Poison, usually high dose or strong concentration. E.g, The human body often reacts very differently to acute and chronic poisoning. Acute poisoning—one contact with the are toxic. Common symptoms of poisoning are nausea, headache, dizziness, difficult breathing, unconsciousness. Gases and methanol (Oral intake). The reason for the delay being that the decomposition products rather than the original product may, however, tolerate a significantly higher concentration in a short time exposure:

In industry the effect of long time exposure of low concentration to a substance is of prime concern. The expression used is TLV (Threshold Limit Value), previously called MAC (Max Allowable Concentration). The TLV-Value expresses the concentration of a substance in air, in ppm or mg/cubicm, which must not be exceeded if a daily 8-hour exposure over a long period of time shall be harmless. TLV-values are published by National Authorities and various organizations. The most recognized list of TLV-values is probably the one published by ACGH (American Conference of Governmental Hygienists). The gas concentration can be measured by means of a portable apparatus. The scale of reference for gas exposure on board is normally TLV-values. Human beings can, however, tolerate a significantly higher concentration in a short time exposure:

Inhalation after less than one hour

<table>
<thead>
<tr>
<th>Substance</th>
<th>Danger of serious poisoning</th>
<th>TLV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acrylonitrile</td>
<td>100ppm</td>
<td>2 ppm</td>
</tr>
<tr>
<td>Trichloroethylene</td>
<td>250 ppm</td>
<td>20 ppm</td>
</tr>
<tr>
<td>Carbontetrachloride</td>
<td>2000 ppm</td>
<td>2 ppm</td>
</tr>
<tr>
<td>Methanol</td>
<td>2000 ppm</td>
<td>200 ppm</td>
</tr>
<tr>
<td>Benzene</td>
<td>10000 ppm</td>
<td>5 ppm</td>
</tr>
</tbody>
</table>

A person who is tired or ill is more sensitive than others and should not be asked to work with cargo handling. It is a good safety practice to use a breathing apparatus whenever the TLV-value in the atmosphere is exceeded.

POISONING

The poison may enter the human body orally, by inhalation, or by skin contact. After being absorbed by the body it may affect certain organs or give a general poisonous effect. Lately the cancerogene effects of some industrial chemicals have been noticed. This has led to significant reductions of hereto accepted TLV-values in many countries. Certain substances affect the tissues locally as an irritant (Cashew nut shell oil) or cause grave damage to the eyes, skin or mucous membranes (Strong acids and caustic). Other substances may be absorbed by contact to the skin without local effects (Nitrobenzene, aniline). Gases, in themselves non-poisonous, may be dangerous by their displacement of air (Nitrogen as an inert gas in cargo tanks). The effect of a substance also depends on the temperature, its solubility in water or (Skin)fats, its volatility etc. Chlorinated hydrocarbons (e.g. tetrachloride and chloroform) may cause damage to kidneys and liver after prolonged exposures. Symptoms of poisoning may appear many hours after contact with the substance. Typical examples are poisoning from nitrous gases and methanol (Oral intake). The reason for the delay being that the decomposition products rather than the original product are toxic. Common symptoms of poisoning are nausea, headache, dizziness, difficult breathing, unconsciousness. The human body often reacts very differently to acute and chronic poisoning. (Acute poisoning—one contact with the poison, usually high dose or strong concentration. Chronic poisoning—small doses or low concentrations over a long time). E.g, Benzene causes reduced consciousness in acute poisoning but causes blood and bone marrow damage in chronic poisoning. Certain chemicals may cause sensitizing upon first contact. Later contacts with the same chemical, even at lower concentrations, may cause much stronger poisonous effects. Typical in this respect are isocyanates (E.g. toluene disocyanates) where asthmatic effects on sensitive persons may occur below TLV-value.

CARGO INFORMATION TO SHIP'S PERSONAL

It is a clear responsibility for the owner, the master of the officers to inform their personnel about the cargoes to be carried, safety procedures etc and to arrange for the proper training. Information should be given partly in the form of written notices combined with informal meetings with the entire crew present when new cargoes are to be loaded or when unexperienced personnel are to be signed on. Among other things the following information should be given:

- Cargoes to be loaded; their characteristics as regards handling, pumping, toxicity, corrosiveness, first aid etc.
- The cargo loading plan to be posted in places where it will be clearly seen by everyone on board and at the accommodation ladder, when in port.
- Post cargo information cards for products to be loaded or are contained on board.
- The personal safety equipment to be used by those involved in cargo handling, pumping, sampling etc.

MAKE SURE THAT YOU:
- Use googles, gloves, oilskin or apron and rubber boots when operating cargo gear.
- Use more extensive personal protection when needed or when ordered to do so.
Know what products are carried on board and that you are familiar with their respective safety measures. Study safety instructions and ask the Chief Officer.

Know where eye flushing bottles are located (pumprooms and on deck amidships).

Know and practise how to flush your eyes with water IMMEDIATELY in case of accident. Eyelids may have to be forced open to permit proper flushing.

Know where safety showers and water rinsing hoses are located in pumprooms and on deck.

Use breathing apparatus in tanks, pumprooms which have not been declared safe or when ordered by officer on duty. Breathing apparatus shall be available for immediate use on deck when loading/discharging.

Never enter dangerous compartments unless ordered by officer on duty. Proper personal protection should be used and personnel should stand by.

Know where the oxygen resuscitation apparatus is located.

Take part in the monthly safety drills.

Have available on board literature on chemical cargoes, medical advice etc.

Inform in particular if the cargo to be loaded has an odour threshold which is higher than the TLV-value, and that dangerous vapours may always be sensed in advance (e.g. allyl alcohol, carbon tetra chloride, ethylene dichloride).

Give information that most vapours are heavier than air and have a tendency to accumulate in low spaces. Therefore work below gratings in pumprooms, cofferdams, pipe tunnels etc is extra dangerous.

Never take work clothes into your cabin. Soiled clothes must be washed before being used again or in the case of toxic products, destroyed.

Wash your hands before meals.

Give information about fire fighting methods for each type of cargo on board.

Give information if the cargo is water-reactive or reactive to other cargoes on board. Give information on segregation required.

For some very toxic cargoes mouth to mouth artificial breathing might be dangerous to the rescuer (e.g. acrylonitril, acetone cyanohydrine).

Information must be given particularly if the cargo danger lies primarily in vapour inhalation (e.g. acrylonitrile, trichloroethylene) or skin contact (e.g. phenol, caustic soda, sulphuric acid).

State where eye washing bottles are located (deck office, at cargo manifolds on deck, in pumprooms, on fore deck etc).

Insist on that nobody should work with cargo gear without anyone standing by. Have people report when going to and returning from pumprooms.

Give information if any cargo is so toxic that an escape breathing mask must be used in an emergency.

7.6 BREATHING AND RESUSCITATION EQUIPMENT

7.6.1 Different Types Of Equipment:

Air may be used in several different ways to provide life support and consequently breathing, rescue and resuscitation equipment is available in many different forms depending on the particular requirement, and is produced by a number of manufacturers.

The main basic types may be listed as follows:

a) Self-contained compressed air breathing apparatus, both demand and positive pressure types
b) Air line breathing equipment served by cylinder pack
c) Air line equipment from ship's air main supply
d) Short duration escape breathing apparatus
e) Emergency life support apparatus
f) Filter canisters
g) Resuscitation equipment

7.6.2 Self-Contained Compressed Air Breathing Apparatus:

The self-contained breathing apparatus is the most versatile and commonly used items of safety equipment found aboard ship.

In normal use, the wearer draws his air supply from an air cylinder (there are also twin cylinder models) which is an integral part of the unit and he is thus able to move about independently.

Some sets are additionally capable of being fed by an air line thus enabling the wearer to work for longer periods while having the security of a reserve air supply in his own cylinder should things go wrong. This method is particularly suitable for working in non-gas free pumprooms and cargo tanks in larger ships.

7.6.3 Working Duration Of C. A. B. A:
working reasonably hard will consume about 40 liter of free air per minute: an inexperienced person can easily double this rate of consumption.

Compressed air cylinders are of various sizes usually of either 4 or 6 litre water capacity. Twin cylinder sets often have two 4 litre cylinders, totalling 8 litre water capacity.

The fully charged pressure of cylinders also varies. Some types are charged to as high as 300 bars but 200 bars/atmospheres /kg/cm² is more common for shipboard use. The maximum charging pressure is always stamped on either the neck or the shoulder of a cylinder.

To obtain the approximate quantity of free air, simply multiply the water capacity in liters by the pressure in either bars, atmospheres or kg/cm². For example, a 6 litre cylinder charged to 200 bars:

\[6 \times 200 = 1200 \text{ litres (app.)}\]

On the basis of a consumption of 40 litres/minute, the rated total duration of such a cylinder would be:

\[\frac{1200}{40} = 30 \text{ minutes.}\]

However, the working duration normally allows for a safety reserve of app. 10 minutes and in this case it will therefore be around 20 minutes.

Using the same simple calculation, the working duration of 9 litre and twin 4 litre 200 bar cylinders will be found to be app. 35 min. and 30 min. respectively.

It must, however, be stressed that these times should be regarded as guidelines only and individuals should obtain an assessment of their own endurance capabilities by practising under differing conditions.

### 7.6.4 Demand Type C.A.B.A:

In most types of CBA, the air passes from the cylinder to a pressure reducer where the pressure is reduced to about 10 bars (varies with type and make) before passing to demand regulator which is attached to the face mask. These sets are often referred to as twin stage.

In some other types, the air is led at full cylinder pressure direct to the demand regulator. These sets are known as single stage. Essentially, from the wearer's point of view, both types meet the same requirements though the single-stage sets are perhaps simpler to maintain.

The air supply hose is attached to a demand regulator which is often attached or screwed directly into the face mask. The flow into the mask is controlled by a tilting valve which is actuated by a diaphragm in the demand regulator. When the wearer is not breathing, no air flows into the mask. When inhaling, however, a slight vacuum is created in the mask causing inward movement of the diaphragm which pushes against and opens the tilt valve resulting in supply of air to mask.

During exhalation, the diaphragm returns to its normal position and the tilt valve closes. The exhaled air exhausts to atmosphere through a separate non-return exhalation valve.

Correct wearing of the face mask is very important. An incorrect fitted mask will allow outside atmosphere to be drawn in during the vacuum stage: a similar danger exists if the wearer has a beard or heavy side burns. Spectacles should not be worn when wearing a face mask for the same reason.

### 7.6.5 Face Masks

Most modern face masks are made of neoprene or similar durable and chemical resistant materials. There are, however, a good many in existence which are made of rubber based materials.

Regardless of type, face mask should always be washed in soapy (not detergent) water after use and then rinsed in clean fresh water, wiped with a clean cloth and allowed to dry gently.

Rubber based masks should periodically be treated with paraffin wax to prevent perishing.

Visors should be protected against scratching. Minor scratches and marks are sometimes unavoidable but most can be easily removed by gently polishing with brass polish.

Exhale valves which are allowed to become dirty will not seal properly and toxic atmosphere may then enter the mask. Rubber valves found in demand type sets will become stretched or perished after a while is two-fold. All exhaled air is confined to the space in this inner mask before it is exhausted to atmosphere. This not only reduces the possibility of a build up of CO2 within the mask as a whole but it effectively minimises misting of the visor.

### 7.6.6 Low Pressure Warning:

Most devices are designed to give app. 10 min. warning based on a consumption of 40 liters/min. but the time interval must never be relied upon and the prudent wearer will always check the pressure gauge regularly.

There are three main types of warning devices:
--whistle
--bell or gong
--reserve air valve.

The latter device operates by markedly reducing the air flow when the pressure reaches a certain minimum level. Normal flow is restored by the wearer pulling a toggle or pushing a button.

7.6.7 Escape Breathing Apparatus:

This equipment is more commonly found aboard gas and chemical tankers where a spillage or escape of cargo could result in a large quantity of toxic vapour being evolved. Sets normally have a total duration of at least 15 minutes to meet IMO requirements and, as they will be worn until either the air has been exhausted or the wearer is clear of the dangerous area, warning whistles are not always fitted. The pressure gauge is normally fitted to the cylinder in order to register continuously thus enabling easy checking of sets in storage without having to open the cylinder valve.

7.6.8 Resuscitation Equipment:

Resuscitation equipment is available in various forms ranging from a simple hand-operated bellows pump to sophisticated equipment that will give automatic resuscitation for periods of 30 min. and upwards and which will function even when a victim is in the process of being hoisted out of a compartment. The media used for resuscitation are either oxygen or air. If oxygen is used, the resuscitation equipment must not be taken into a potentially flammable atmosphere unless it is approved for that purpose. Oxygen escaping under pressure can cause a spontaneous explosion in such conditions.

7.6.9 Maintenance:

It is clearly of utmost importance that breathing and resuscitation equipment be maintained in efficient working condition at all times. It should be checked by a responsible officer at least once a month and after every occasion when it has been used. Annual servicing should be carried out by the manufacturers or by the some other competent person. A record should be kept of all servicing and renewal of parts. Only the manufacturers spares should be used. Cylinders should be inspected for scratches or other breakdown of painted surface and repainted as necessary. They are required to be hydraulically tested and re-certificate every five years. Cylinders should not be left empty with their valves open as this will allow moist air to enter and corrosion of the internal walls will result.

7.7 STATIC ELECTRIC, CARGOES WHICH CONTAIN IN STATIC ELECTRIC AND PRECAUTIONS

7.7.1 General

Occurrence static electric on vessel body might be caused sparks which ignites explosive and flammable gases. Some of routine operations might be concluded electrostatic current. Precautions should be taken actions are given in this chapter to reduce minimum for imminent dangers. If cargo has produce tendency static electric and flammable gas produces, risk of danger will be grown. In handling temperature or during loading in tank might be contented flammable mixture. This kind of cargoes was mentioned in additional list.

1) Uninterrupted electric
All liquids which couldn't keep liquid form continuously, water vapour which produced by steam jets, during tank cleaning, water vapour is occurred including spraying condition for all the chemical products (flange leakage under pressure), free falling effects of cargo during loading operation, might be caused electric charge.
If electric charge flows between ship and pier in insulate way, some of electric current should be immediately taken by flenge or other metal parts for neutralizing. For prevention collecting of danger voltage all the metal flenges and other internal metal parts should be connected in sufficient distance, continuously earthing should be provided. If metal supporter in flexible hose connects to flenge, continuous conductor way to earth will be occured (At manifold and at vessel keel). If shore connection has isolate flange, internal flengesship manifold will be continuous earthed due to vessel keel way.

2) Classifying of chemical products due to electric charge accumulate;

2.1 Non accumulators

Example;
- Alcohol,
- Ketons.

2.2 Accumulators which conductorability poor;
- White spirite,
- Naphtas,
- Lubricating oil,
- Solvent,
- Aromatic products.

2.3 Products which has low pressure flash point is over 38degC and loading temperature is lower 8degC flash point chemical products after discharging should be gas freed under 20% L.E.L.

2.4 Intermediate vapour pressure product (IVP)

During loading (T:0-38degC). This products are flammable vapour pressure rate lower than 0.345bar or flash point lower than 38 degC.

- They should avoid mixing by water,
- Loading rate at beginning should be over 1m/sec.
  - For 3inch line-16cubm.
  - For 4inch line-29cubm
  - For 5inch line-44cubm.
- Although loading rate restriction would be carried out. During loading or until completion loading after 30 minutes shouldn't be used any conductive type portable ullage tape meter, sample device, thermometer etc., against static electric danger should be minimized.
- Unconductive appliance are device can be used, all ropes have to be manila or cotton, hand made entetic polymer ropes shouldn't be used.
- Floating gauge system is safety against for static electric's danger.

2.5 High vapour pressure products (HVP);

Chemical products which liquid vapour pressure rates are higher than 0.345bar loading should be adjusted due to UFL, during loading always give sufficient void space which content over UFL vapour mixing. If loaded cargo temperature in tank under 0degC, at any moment flammable rich vapour mixing by air will be in tank, so all precautions above mentioned at IVP should be carried out.

3) Static electric which might be occurred in tank during various operations;

- During loading, discharging of static electric producing chemical products,
- Tank cleaning by pressure water machines,
- Steaming.

During this operations; chemical products, water droplets or water vapours will be rub oneself and finally they have electric current on them which try to discharge to earth Electric current will be discharged normally to earth via keel but if it doesn't discharge sufficient it can be caused a hot spark which can cause ignition the flammable vapour when static electric accumulated without discharging to earth in tank, if any metal object is put in tank. Electric jump with sparks can be occurred in tank. If a carbondioxide under pressure discharges static electric and sparks can be occurred too. After discharging of product, flammable gas remains in tank if there is no precaution during tank cleaning. This flammable gas will be dangerous.

4) Precautions during tank cleaning procedures;

- Tank openings should be closed as possible as.
- Don't put in tank any metal devices except bonded wire tank machines.
- Until tank cleaning hose will be taken out and taken away don't disconnect with hydrant.

5) Cargo flow speed;
If product has water content, flowing in pipe product will be provided more static electric. Water moves in between layers of product due to different of density, water flowing caused occurring more serious static electric accumulation. If static electric occurs for this reason it might be continued even after completion of loading. For avoiding minimising danger should be done as follows;

If tank has flammable vapour or gas and drop line mouth or if loading through pump; pump mouth length from bottom is higher than 0.5m, loading flow in pipe shouldn't be over 1m/sec. at beginning. After beginning flow speed in pipe might be 12m/sec. but not over.

-If tank has not flammable vapour or gas;
  If flammable or explosive products loading temperature is equal or over explosive or flammable temperatures of product, loading flow rate should be restricted. If on the contrary, it won't be necessary restriction of flow rate.

-If tank purged by Nitrogen before loading;
  Not necessary restriction of flow rate. At beginning of discharging rate will be adjusted due to shore request. If shore wants to increase it should increase. If loading is carried out through tank cover. Vapour mixing with static electric may be reach in dangerous. Loading should never carry out through tank cover. However unvapourised product can be loaded through tank cover (F.P60degC).

-Storm with electric, lightning;
  If there is storm with electric, lightning cargo operation should be ceased.

### 7.7.2 Chemical Products List Which Produces Static Electric

<table>
<thead>
<tr>
<th>Product</th>
<th>Possible</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-Acetic acid</td>
<td>Possible</td>
</tr>
<tr>
<td>2-Acrylonitrile</td>
<td>&quot;</td>
</tr>
<tr>
<td>3-Amyl acetate</td>
<td>&quot;</td>
</tr>
<tr>
<td>4-Isoamyl acetate</td>
<td>&quot;</td>
</tr>
<tr>
<td>5-Isoamyl alcohol</td>
<td>&quot;</td>
</tr>
<tr>
<td>6-N-amyl alcohol</td>
<td>&quot;</td>
</tr>
<tr>
<td>7-N-butyl acetate</td>
<td>&quot;</td>
</tr>
<tr>
<td>8-Iso butyl acetate</td>
<td>&quot;</td>
</tr>
<tr>
<td>9-Sec butyl acetate</td>
<td>&quot;</td>
</tr>
<tr>
<td>10-Butyl acrylate</td>
<td>&quot;</td>
</tr>
<tr>
<td>11-Carbon tetra chloride</td>
<td>&quot;</td>
</tr>
<tr>
<td>12-O-cresol</td>
<td>&quot;</td>
</tr>
<tr>
<td>13-Cyclohexanol</td>
<td>&quot;</td>
</tr>
<tr>
<td>14-Cyclohexanone</td>
<td>&quot;</td>
</tr>
<tr>
<td>15-P-cymene</td>
<td>&quot;</td>
</tr>
<tr>
<td>16-N-decanol</td>
<td>&quot;</td>
</tr>
<tr>
<td>17-Diisobutylene</td>
<td>&quot;</td>
</tr>
<tr>
<td>18-Dichloromethane</td>
<td>&quot;</td>
</tr>
<tr>
<td>19-1,2-Dichloropropene</td>
<td>&quot;</td>
</tr>
<tr>
<td>20-Dicyclopentadiene</td>
<td>&quot;</td>
</tr>
<tr>
<td>21-Epichlorohydrin</td>
<td>&quot;</td>
</tr>
<tr>
<td>22-Ethyl acetate</td>
<td>&quot;</td>
</tr>
<tr>
<td>23-Ethylene dibromide</td>
<td>&quot;</td>
</tr>
<tr>
<td>24-Ethylene dichloride</td>
<td>&quot;</td>
</tr>
<tr>
<td>25-Ethylene chloride</td>
<td>&quot;</td>
</tr>
<tr>
<td>26-Heptan I-ol</td>
<td>&quot;</td>
</tr>
<tr>
<td>27-Methylamyl alcohol</td>
<td>&quot;</td>
</tr>
<tr>
<td>28-Lead alkyl anti-knock compounds</td>
<td>&quot;</td>
</tr>
<tr>
<td>29-Phenol</td>
<td>&quot;</td>
</tr>
<tr>
<td>30-Polypropylene glycol</td>
<td>&quot;</td>
</tr>
<tr>
<td>31-Isopropyl acetate</td>
<td>&quot;</td>
</tr>
<tr>
<td>32-Isopropyl benzene</td>
<td>&quot;</td>
</tr>
<tr>
<td>33-Sulphur(Molten)</td>
<td>&quot;</td>
</tr>
<tr>
<td>34-Sulphur dioxide</td>
<td>&quot;</td>
</tr>
<tr>
<td>35-Trichlor ethane</td>
<td>&quot;</td>
</tr>
<tr>
<td>36-Trichlor ethylene</td>
<td>&quot;</td>
</tr>
<tr>
<td>37-Vinylidene chloride</td>
<td>&quot;</td>
</tr>
</tbody>
</table>

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7.7.3 Chemical Products May Be Reacted During Voyage

Some of chemical products which carry on chemical tankers may be reacted being chemical. Chemical products which carry on chemical tankers;
-They may be reacted spontaneous,
-They may be reacted with air,
-They may be reacted with other one chemical product,
-They may be reacted with water.

If chemical products which carry on chemical tankers react being chemical, as follows reactions will be occurred;
1-Heat occurrence,
2-Vapour occurrence,
3-Increase of tank pressure,
4-Product quality influences negative,
5-Flammable or fire risks possibility increase,
6-Product's polymerization occurs.

Before chemical products which carry on chemical tankers react being chemical. Reactions can be prevented with various precautions. Main of precautions as follows;
1-If inhibitor uses in product, product will be stable and continue undangerous condition,
2-If Nitrogen blanket makes to void space of tank contact with air and reaction will be prevented,
3-Materials which don't enter in chemical reaction should be used for cargo handling operations. Example; aluminium/brass shouldn't be used.
4-If products which react in each other load, they will load in between compatibility products, or they will keep in between empty tank, cofferdam or they will load cross (Diagonal contact) product with incompatibility. For this reason before loading, compatibility chart should be examined carefully and suitable cargo plan will be planned.
5-If chemical product which reacts with water loads. Tank's heating coils which is going to load should be flushed and blanked.

7.7.4 Carrying Cares During Voyage

Responsibilities
- The Master is responsible for the safe carriage of the cargo and to see that ship’s crew under the supervision and responsibility of the Chief Officer takes all due care and precautions.
- The Chief Officer is responsible to carry out the routines and/or the additional requirements (e.g. heating, inhibitor application, nitrogen blanketing, circulation, etc.) for ensuring the well being of the cargo.
- The assigned deck officer and/or bosun/pumpman is to check every day the watertight integrity of the cargo tanks, leakage or any abnormal situation that may cause a concern on the cargo and he is to report his check results to the Chief Officer.
- The Chief Engineer is responsible to fulfill the cargo requirements which is related with engine, such as heating requirements.

Description
During the carriage of the cargo, following actions are to be taken:
- Ensure that the cargo is not under threat of water ingress by checking visually that the tank covers, ullage lids, butterworth lead covers are seated tightly.
- Ensure that the cargo is not leaking through any passage from the cargo tank into the double bottom tanks or void spaces or cofferdams, by checking the ullages of the cargo and the soundings of ballast tanks, or checking for cargo odour or gas presence in such spaces (GF-6.02 A Ballast Tank / Void Space Checklist), or by litmus paper test of the water sample taken from ballast tanks, or by whatever means the Master may envisage.
- If cargo is to be heated, coordinate with the Engine Department and apply controlled heating, checking the temperature readings and record the readings in the Cargo Log Book and GF-6.02 B Cargo Tank Heating Checklist.
- If cargo is of such a nature that is not to exceed a certain temperature, and if vessel is navigating in a warm climate conditions, then cooling application such as water spraying is to be executed and temperature readings are to be observed and recorded in the Cargo Log Book.
• If cargo is of such a nature that needs chemical application to remain stable and preserve its characteristics, such as inhibitor application, then, such inhibitor which is to be supplied by the shipper, will be applied as per written instructions of the shippers/charterers.

- P/V Valves at cold whether condition should be cared, because of freezing cause,
- High temperature in tank for heating products can be caused thermal stresses.
- If a product has high freezing point and carries in environment temperature either increase viscosity or become solid.

7.7.5 Heating

Heating in cargo tanks usually has three different heating systems;
1- With hot water  2- With steam  3- With thermal oils.

The maximum steam temperature should preferably be 130-150degC(3-5kp/sqcm.). Product temperature should be checked at interval regularly from top and bottom of product level in tank. Heating log book should be kept during voyage due to heating instruction. If heating product has abnormal temperature amplitude, Caution will be taken immediately and should be informed to company. Products which to be occurred sludge in bottom like a phosphoric acid or the one that resembles it circulate through drop line. High steam heat can cause changing colour of product like a phenol. Because of product quality can be spoiled. So heating instruction should be read carefully.

7.7.6 Nitrogen Blanketing

If product reacts with air, Nitrogen blanket will be made at completion of loading. Nitrogen blanket is purged air from void space of tank and then tank will be kept under positive pressure due to P/V working pressure, so after nitrogen blanket will be cut contact with air and blanketing on the product.

7.8 PERSONEL SAFETY

7.8.1 Slips, Trips And Falls:

Many injures are caused by slips, trips and falls, particularly those incidents which results in loss time. Be careful and observe the following rules.

1- The following situations are slip, trip and fall hazards.
   - Wet floors/Decks
   - Oily floors/Decks
   - Highly waxed and polished floors /Decks
   - Icy Spots

   a) Good traction helps prevent slipping. The sole material of some shoes, and worn soles may increase the chance of slipping. Always wear shoes that provide good traction.
   b) Remove any spilled liquid from the deck immediately.
   c) Keep small items, such as those which will roll and cause slipping, off the floor.
   d) When using wrenches, make sure that your footing is stable in case the wrench slips or releases quickly.

2- In addition to the tools used in day to day operations, many items can cause tripping hazard such as hoses, lines, shallow holes, extension cords, loose shoe laces, etc. Take action to eliminate tripping hazards where possible.

3- To prevent falls, every opening on deck, or walkway must be protected to prevent an accident. The openings should be protected by barricades, railings, roped off, or constantly attended.

4- When working in elevated locations where falls are possible:

   a) Take special precautions in locations without handrails
   b) Wear safety lines when working in locations unprotected against falling more than about four feet. Lesser heights may also call for safety lines.
   c) Temporary barriers should be rigged to prevent failing where safety lines cannot be used.
   d) Use safety harnesses rather than safety belts, since harnesses provide more protection against injury.

5- Barricades shall be used to prevent entry into an area that is considered unsafe.
6-Good housekeeping helps prevent slips, trips and falls.

7-NEVER RUN.

8-NEVER use a ladder that is not in good condition. Always place the foot approximately 1/4 the length of the leader from the vertical surface, and secure it.

### 7.8.2 Stairs And Walkways:

1-When carrying tools or material, ALWAYS keep one hand free to use the handrails as you go up and down stairways.

2-All steps, walkways and stairs MUST be kept free of obstructions and slippery materials such as oil and grease.

3-When walkways and steps are provided, they must be used. Do not take shortcuts.

4-Tools, equipment and material must not be left on walkways.

5-NEVER use a handrail or railing as an anchor point for load: do not sit on a rail, nor depend on it to do more than it was designed for - to provide only a barrier.

6-Walkways and handrails should be inspected periodically to determine their strength and integrity.

7-The use of colours to identify tripping hazard is encouraged.

8-Secure hoses and electrical cords whenever they are laid across walkways.

### 7.8.3 Handling Lines:

1-All lines should be coiled and stowed when not in use.

2-Use guide hooks to guide wires onto winch drums.

3-When working with blocks, handle the line far enough away from the block to prevent hands from getting pulled into the block.

4-When handling a line which may suddenly come under tension, avoid placing hands in the eye, particularly if it is being placed on a bollard or other device that might trap the hand.

5-Do not stand in the bight of a line or a coil of line.

6-Stay clear of all lines, and when working with lines under tension, stay out of areas which might become dangerous if the line should part and recoil.

7-Always use the right size (strength) of line for the job. Never put lines under 1” diameter to a winch or other mechanical assist.

8-Lines that will be used where strength is of primary importance to the safety of personnel should be closely examined for deterioration from wear, chemical contact or weathering. Wherever possible use a new line.

### 7.8.4 Hearing Protection:

Hearing damage from noise is usually the result of long-time repeated exposure to excessive noise levels. Since the damage to hearing is not reversible with time or treatment, it is important to adhere to the following requirements.

1-Hearing Protection:

A- The use of hearing protectors is mandatory for all personnel in designated areas. This shall include non-company personnel aboard all vessels.

**All engine rooms will be designated areas. Entrances shall be posted with signs reading "Caution" Hearing Protection Required Beyond this Point." The notice "Caution: Hearing Protection Required in this area" shall also be posted in conspicuous places within the engine room.**

**Areas other than engine or pump rooms may be designated and shall be treated similarly whenever the noise level makes ordinary conversation difficult to hear.**

B-Self-fittings foam earplugs are the recommended protection for most applications.

**Foam earplugs are convenient yet provide ample hearing protection in most situations when worn properly.**

**Experience has proven that in noisy areas earplugs make it easier to hear voices and radios by filtering out high frequency background noise.**

**To facilitate radio communication, clip the hand microphone of the radio unit to the collar when in noisy areas.**

**Dirty earplugs should never be inserted; try to carry a spare set.**

**Any persons experiencing difficulty wearing earplugs may wear earmuffs.**

**Earmuffs or band mounted foam plugs may be preferred by persons who must frequently go in and out of designated noisy areas for short periods of time.**

**Earmuffs should be issued to personnel on request and must be kept clean by each user.**
7.8.5 Electrical Work:

Work on electrical circuits requires an extra degree of attention due to inherent dangers which can result in serious burns or fatalities.

1-Before beginning any work that could involve electrical circuits or equipment, the job must be discussed with the chief engineer to determine the potential exposures to electrical shock, any inter-connecting circuits and the potential effect on ship's operations.

2-Any such job, even after evaluation and following the safety rules herein, must be planned out with the engineer on watch or engineer in charge of the work and the C. Engineer.

3-No work shall be performed on energized equipment or circuits where there can be direct exposure to more than 50 volts. It is the responsibility of the engineer in charge to de-energize such equipment and/or circuits and place or ensure that a signed tag is placed on the disconnect device, locked in the disconnected or open position.

4-No one shall operate such a tagged or locked protective device or reconnect such tagged circuits, except the person whose signature is currently on the tag. The person whose signature is currently on the tag, the person who signs the tag has full responsibility to see that all personnel are clear of any involved circuits before removing the tag and energizing the circuit.

5-If the time required for the work necessitates a change in personnel, a full discussion of the safety steps taken shall be discussed with the incoming personnel. If this involves the person who performed the tagging, the new person shall go with that person to each tagged device or circuit and remove the old tag and replace it with the new person's signature on a current tag.

6-Where operations because of an emergency, or other reason, requires working on energized equipment or circuits, the following safeguards shall be followed:
   a) The C. Engineer must supervise the total job including the preparation stages and initial testing.
   b) Those doing the work shall wear electrician's gloves which have been stored in a sealed bag.
   c) A face shield or goggles should be worn.
   d) Rubber blankets shall be used to isolate the immediate work area from energized parts.
   e) A fire extinguisher approved for electrical fires shall be close by.
   f) At least one additional person must at all times standby to observe the work, assist in assuring the safety of the one doing the work and respond in the event of an accident.

7.8.6 Handling Caustics And Acids:

Caustics and acids must receive special attention in storage, handling and use, because with few exceptions they can cause immediate harm to personnel. They are corrosive and severely irritating to the skin, eyes and respiratory tract. Often significant injury may occur even before first aid can be applied. This standard should serve as a reminder to exercise the utmost caution and care when possible exposure to caustics and acids exist.

1-Eye protection is mandatory. A face shield and goggles provide good protection to the face.

2-Hands must be protected by the use of chemical resistant gloves.

3-Body protection shall consist of chemical resistant aprons and rubber boots.

4-Rooms in which concentrated acids are used must be open or well ventilated.

5-Containers must have suitable means to allow extracting the material in a safe manner to minimize risk of spillage and splashing.

6-Wear protective equipment when opening containers, because of the possibility of internal pressure which may cause spraying.

7-When diluting an acid, always add the caustic to the water, slowly, to minimise risk of splashing. Never add water to caustics.

8-When mixing caustics, always add the caustic to the water, slowly, to minimise risk of splashing. Never add water to caustics.

9-Always follow any mixing directions that may be on the container.

10-Empty containers should be flushed and washed thoroughly to eliminate any residue that might subsequently cause harm.

11-If acids or caustics come into contact with the body, flush the affected parts for 15 to 20 minutes with clean water. This is particularly important for the eyes.

7.8.7 Portable Ladders:

1-Always check to be sure a ladder is in good condition before using. Discard any ladder when the side rail or rungs are bent, deformed or cracked. Never use a ladder when a rung is missing, the ladder is not sturdy or where either make-shift or major repairs have been made or attempted.

2-All portable ladders must have shoes in good non-skid condition.

3-Place a straight ladder with its feet approximately 1/4 the ladder length away from the vertical surface it rests against at the top.
4-Be sure the footing is solid and secure and the top rests against a solid surface that will not give under the pressure of the ladder in use.
5-Have someone hold the base and secure the top if possible; otherwise secure the ladder in use.
6-Use only wooden, fiberglass or other type ladders approved for electrical work when working on or in the vicinity of electrical circuits.
7-Do not paint wooden ladders. Keep all ladders clean of grease and oils.
8-Ladders are designed to carry only one person.

7.8.8 CRANE CONTROL

The crane is operated from the platform which is welded on the slewing body. The levers on the open platform, control the piston, slewing system and cargo winch. Labels on the panel cover guide the operator. The range of lever movements effect the crane movement speeds. The first movement must be gentle to provide smooth and soft operation of the crane. Once the movement is started, speed can be increased by pushing or pulling the level further.

Operations

In order to operate the crane, push the start button on the electric starter panel labeled “Hose Crane” which is located in a safe, isolated location. Once the hydraulic power is supplied to the crane by pushing the start button, operations are controlled using the levers located on the crane platform. After the operations, system must always be turned off by pushing the “stop” button. If not, hydraulic oil can be overheated.

Before Starting

READ INSTRUCTIONS CAREFULLY BEFORE TAKING CRANE INTO OPERATION.

Notify responsible officer onboard before taking the crane into operation. Make sure there is nobody in the crane hose who might get caught in the machinery or strangled by the by ropes. Check that control levers are in neutral position. If not, notify responsible officer. Check if the thermostat is adjusted correctly. If not, notify responsible officer.

Starting

Press the start button on the electric box. Pay attention to the warning lights. If any of the lights are on, stop crane and eliminate reasons. Then restart.

Operation

Operate the crane with gentle and slow movements on the control levers so that the crane always moves smoothly. Verify that the ship does not trim or list more than the values specified on the particulars pages. Dragging loads is not permitted. Do not drag loads since this type of action results in a sudden tension and load on the complete crane structure. If the crane gets out of control, let go all the control levers and press the emergency stop button.

Functional Descriptions

Electro-Hydraulic Power Unit

Electro-hydraulic power unit either located in a safe and isolated place below forecastle or integrated to crane housing for compact usage. For absorbing various amplitude vibrations, an elastic coupling is placed between the electric motors and hydraulic pump. Pump takes oil from the tank with free suction. Security valve, which is connected at the end of the tank on the pressure line with T fitting, secures the system from any overloading faults. The filter on the return line cleans the returned oil. The removable cartridge type filter element must be changed after sufficient use (which can be determined by the visual filter indicator). The oil level that is observed on the indicator must always be high as 2/3 of the indicator height or higher. If the oil level is lower than stated herein, oil must be added into the unit through the filling cap. For determining the most suitable oil please refer to the lubrication charts located at the end of this manual. Tank cleaning must be performed every time the oil replaced as inscribed on the maintenance section of this document.

Slewing System
The roller bearings, designed for slewing system, give high performance in heavy marine conditions. Lubrication must be carried out from the lubrication points on the roller bearings periodically with 5 or 6 strokes of a hand pump as inscribed in maintenance section. Irregular or incorrect lubrication reduces the durability of slewing roller bearings. The main slewing gear is an internal gear system that runs with the pinion gear which is located on the end of the slewing gear. Slewing gearbox is designed with planet gears and is driven by hydraulic motor. Gearbox brake consists of a load holding valve that runs together with safe lamellar brake system.

Cargo Winch

Cargo winch consists of a wire drum that is attached to a hydraulic driven planet gearbox. Winch brake consists of a load holding valve runs together with safe hydraulic lamellar brake system. The gearbox must be filled with gear oil until the oil level reaches the oil observatoin window. Oil refilling period is 5 years. Oil level must be checked daily. Each wire rope must be reversed end to end 5 years after assembly. (Wire end that holds the hook must be wound around the drum as the first winding). Wire ropes must be greased thoroughly. Wire rope pulleys are of bronze alloy and their axles are stainless steel. Lubrication must be carried out through the grease lubrication nipples on the stainless steel axles periodically with 5 or 6 strokes of a hand pump as inscribed on the maintenance section.

Piston

The piston that activates the crane jib is designed for heavy marine conditions. Spherical roller bearings are mounted to piston joints. Lubrication must be carried out through the grease lubrication nipples on the stainless steel axles periodically with 5 or 6 strokes of a hand pump as inscribed on the maintenance section.

7.9 SAFETY CLOTHES AND EQUIPMENT

Safety equipment are stowed in special safety lockers which are exclusively used for this purpose. The crew has to wear the company supplied overalls during working hours. Shore installations will interrupt or even not commence loading/discharging operations if the crew does not wear proper working clothes.

Safety helmet
The use of the safety helmet is required during:
(i) Work with ropes
(ii) Mooring operations on deck
(iii) Loading/discharging operations on deck
(iv) Cargo gear operations
(v) Work in tanks, cofferdams, cargo hatches, pump rooms and engine rooms
(vi) Tank cleaning
(vii) Repair, service, maintenance in deck/engine areas
(viii) Shipyards periods
(ix) Fire/boat/safety drills.

Missing safety helmets are the main reason for accidents.

Safety shoes
The wearing of safety shoes is required:
(i) During working hours and on watch
(ii) After working hours everyone has to wear safe and no slippery shoes.

Safety goggles
The wearing of safety goggles is required during:
(i) Work with metal cutting tools and during grinding operations
(ii) Derusting operations
(iii) Chisel operations
(iv) Work with chemicals, especially acids or caustics
(v) Boiler cleaning operations
(vi) Welding/burning operations
(vii) Purging of tank level gauging equipment

Visors always have to be used when injuries of the face are possible. Safety goggles and visors have to be used together. Quantity and condition of the visors have to be checked regularly. The quantity of usable visors shall not below ten.

Breathing apparatus
The use of breathing apparatus is required during:
(i) Operations in harmful atmospheres, i.e. poisonous, corrosive, irritating gases, hazes or dusts
(ii) Operations in hot gas freed tanks, cofferdams or any other spaces.

Gas mask with the suitable filters are to be used only if sufficient oxygen has been measured in the atmosphere, or the spaces are to be ventilated until the entrance is possible without filters. Filters must be used in strict compliance to the makers manuals. Should there any dupt about the use of filters in a particular atmosphere a breathing apparatus is to be used, or alternatively, the space has to be gas-freed until an entry without a gas mask is possible.

Working gloves and protecting clothes
The use of working gloves and protecting clothes is required:
(i) During welding operations
(ii) During operations with corrosive chemicals
(iii) If there is the possibility of injuries caused by burning or scald
(iv) If there is the possibility of hypotermia
(v) If there is the possibility of injuries caused by electrical shock/current
(vi) During work with wires, ropes and cables.

Ear protection
The wearing of ear protection is required:
(i) In rooms, specified as noisy, engine rooms, close to noisy engines
(ii) During work with noisy machines.

Safety belts (with fall absorption)
The use of safety belts with damping equipment is required during every work with risk of a fall, i.e.:
(i) In cargo gear
(ii) On stages
(iii) Outside bulwark
(iv) On fixed ladders and/or secured ladders.

Working safety vest
The use of working safety vest is required during:
(i) Every work outside bulwark
(ii) Inspection and work of/in the lifeboats
(iii) Bad weather on deck
(iv) Boat drills
(v) and is recommended when entering or leaving a barge.

Dust mask
The use of dust mask is required during:
(i) Boiler cleaning
(ii) Dusty work in cargo hatches
(iii) Spray painting work.

Equipment inspection
Chemical and gas protection clothes are to be maintained according to makers instructions and checked for damages regularly. Safety helmets are to be changes, as a precaution, every five years. New helmets are to be marked with the date of the firs use.

7.10. PERMIT SYSTEM
Following operations must be done under permit system;
* HOT WORK PERMIT  
* ENTRY/WORK PERMIT  
* SEA WATER PERMIT  
* ENTRY ENCLOSED SPACES  
* ELECTRIC CIRCIT WORK PERMIT  
* WORKING ALOFT AUTBOARD  
* SMALL CRAFT ALONGSIDE  
* UNDERWATER WORK PERMIT  
* WORKING ON PIPES PERMIT

7.11. Energy conservation. Limitation of atmospheric pollution:
The company aware of the importance, from the economic and environmental points of view, of the need to reduce, as far as possible, the fuel consumption of ships.

For this purpose, the following should be complied with:

1. As far as possible, all internal combustion engines should be made to function under a load corresponding to peak efficiency. Before leaving the port for a new voyage, the Master should therefore plan the speed of the ship so that unnecessary fuel consumption is avoided.

2. The Technical Department should, for every voyage, evaluate the fuel consumption of each ship and compare the new values with the old ones in order to ascertain the possible need for hull cleaning.

3. The Chief Engineer and the Technical Manager shall carefully control the performance of the main and auxiliary machinery and of the boilers and provide the necessary maintenance in order to achieve maximum efficiency.

All the Officers and other crew members should inform the Engineer Officer on watch ( or the Engineer on duty on unmanned ships immediately if black smoke is seen coming from the funnel.
Before joining to the ship, a training will be applied to the Chief Engineer and Engine Officers by the Technical Manager and Technical Superintendent.

7.12. Cargo Equipments Maintenance and Controls

Refer to the Planned Maintenance Deck Part 1 and 2 for the Maintenance of the Cargo tanks, ballast tanks, void spaces and cofferdams.

- Cargo lines must be checked monthly and recorded in GF-6.05 A by the ch.officer in view of the below mentioned items. One copy of GF-6.05 A will be returned within 3 monthly intervals to the company and one copy will be retained in ships files.

1. The cargo lines must be completely fitted with the static electrical cables and u-bolts.
2. The drain valves and blinds must be cleaned at every washing and must be closed prior to every loading operation.
3. The foundation that supports the cargo lines at the manifold must be whole.
4. The presently operated cargo line must be fitted with a pressure gauge.
5. Check whether the annual test marks are available on the cargo lines.

- Cargo hoses must be checked prior and after every use and must be recorded in GF-6.05 A by the ch.officer in view of the below mentioned items. One copy of GF-6.05 A will be returned within 3 monthly intervals to the company and one copy will be retained in ships files.

1. Cargo hoses must be checked visually before every use.
2. The certificate of the cargo hoses must be checked before use to ensure that the cargo hose to be used is suitable for the cargo and pressure.
3. The cargo hoses should not be dragged over a surface or rolled in a manner, which twists the body of the hose.
4. All used cargo hoses must be cleaned and washed with fresh water after every use.
5. Cargo hoses must be blind when the hoses are not in use.

- Cargo Valves must be checked monthly and recorded in GF-6.05 A by the chief officer in view of the below mentioned items. One copy of GF-6.05 A will be returned within 3 monthly intervals to the company and one copy will be retained in ships files.

1. The leakage of the cargo valve must be checked.
2. Any leakage cargo valve must be repaired.
3. The Valve disc and hand-wheel must be checked.
4. The nuts should be tight to avoid any leakage from picking. If the leakage cannot be prevented, the pickling must be changed.
5. The valves should be marked.

- The Heating system must be checked and recorded in GF-6.05 A by the chief officer in view of the below mentioned items before each loading port. One copy of GF-6.05 A will be returned within 3 monthly intervals to the company and one copy will be retained in ships files.

1. The Heating coils must be checked by air or steam before loading heated cargo(es).
2. The Heating coils inlet flanges must be blinded before loading non-heated cargo(es). The heating coils must be purged by air and controlled for leakage after discharging operations.
3. The u-bolts of heating coils must be checked after discharging operations.
4. The steam valves of the heating system must be without any leakage. The picking of the steam valves must be changed if of any leakage.
5. The circulation system and the heater must be checked before loading heated cargo. (Only for vessels with hot water circulation systems)

- The P/V Valves and gas return line must be checked and recorded in GF-6.05 A by the chief officer in view of the below mentioned items before using. One copy of GF-6.05 A will be returned within 3 monthly intervals to the company and one copy will be retained in ships files.

The Pressure reading of Oil Tankers: 0,140 bar - vacuum reading 0,035 bar
The Pressure reading of Chemical Tankers: 0,210 bar – vacuum reading 0,035 bar
1. The leakage of the P/V valves must be checked.
2. The seats in the P/V valves must be checked.
3. The P/V valve flame screens must be checked in order to avoid any contamination.
4. The flanges over the P/V valves must fully fitted with all nuts.
5. The ladder of the P/V valves should be in good condition.
6. The gas return line must always be cleaned after any use.
7. If requested by the shore, the pressure drop of the gas return line should be calculated.

- The High-level alarms must be checked and recorded in GF-6.05 A by the chief officer in view of the below mentioned items before each loading operation. One copy of GF-6.05 A will be returned within 3 monthly intervals to the company and one copy will be retained in ships files.

1. The high level alarms must be checked before loading.
2. The light and voice alarm belong the system must be checked.
3. The cables on deck belong the high level alarm must be checked and must be in good condition.
4. The boxes on deck belong the high level alarm must be checked before every loading operation. The boxes must be avoided from water.

- Cargo pump emergency stop test must be done and recorded in GF-6.05 A by the chief officer before each loading operation. One copy of GF-6.05 A will be returned within 3 monthly intervals to the company and one copy will be retained in ships files.
- The tank cleaning hoses must be tested (including meger test) and recorded in GF-6.05 A by the chief officer before using. One copy of GF-6.05 A will be returned within 3 monthly intervals to the company and one copy will be retained in ships files.
- The test equipments must be tested and recorded in GF-6.05 A by the chief officer before using. One copy of GF-6.05 A will be returned within 3 monthly intervals to the company and one copy will be retained in ships files.
- GF-6.05 B  Pressure Measuring Equipment Check Records
  The tests of the pressure measuring equipments are done in monthly intervals. One copy of GF-6.05 B will be returned monthly to the company and one copy will be retained in the ships files.
- GF-6.05 C  Portable Thermometers Calibrations Check Records
  The calibrations of the portable thermometers are done in monthly intervals. One copy of GF-6.05 C will be returned monthly to the company and one copy will be retained in the ships files.
- GF-6.05 D  Remote Temperature System Calibration Check Records
  The calibration of the Remote Temperature System are done in monthly intervals. One copy of GF-6.05 D will be returned monthly to the company and one copy will be retained in the ships files.
- GF-6.05 E  Emergency Cargo Pump Performance Condition Test Records
  The performance condition tests of the emergency cargo pump (s) are done in monthly intervals. One copy of GF-6.05 E will be returned monthly to the company and one copy will be retained in the ships files.
- The Cargo & Deck Equipments Lubrication maintenance and the MMC/UTI test and calibrations and the Loadmaster test records will be recorded on weekly intervals at GF-6.05 F Weekly Control Records(CargoEquipment) and kept in ships file. The test and operation records of the ODME (Oil discharging monitoring equipment) will be also recorded at GF-6.05 F and one copy to be kept at the relevant equipment and a second copy at the ships files.

CONTOL AND MONITORING OF MEASURE EQUIPMENTS
The practice to protect, calibrating and verifying of the monitoring and measure equipments necessary to protect, measure and handling the cargo is as follows.

<table>
<thead>
<tr>
<th>Measure Equipment</th>
<th>Calibration Intervals</th>
<th>Executing</th>
<th>Verifying</th>
<th>Accept. Criteria</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed Level/Temperature/Pressure Measure</td>
<td>With 10 Years Intervals / Together with the 3rd Special Survey.</td>
<td>Manufacturer or Authorized representative</td>
<td>-</td>
<td>Level-D Temperature-A Pressure-B/C</td>
<td>On board</td>
</tr>
<tr>
<td>Gas Detection System</td>
<td>With 10 Years Intervals / Together with</td>
<td>Manufacturer or Authorized representative</td>
<td>Annually with SPANGAS</td>
<td>E</td>
<td>On board</td>
</tr>
<tr>
<td>Equipment Type</td>
<td>Execution Details</td>
<td>Calibration Intervals</td>
<td>Executing Verifying Accept. Criteria</td>
<td>Remarks</td>
<td></td>
</tr>
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<td></td>
</tr>
<tr>
<td><strong>Portable Tank Ullaging Equipments</strong></td>
<td>Annually</td>
<td>-</td>
<td>D</td>
<td>At Laboratory</td>
<td></td>
</tr>
<tr>
<td><strong>Portable Gas Detection Equipment</strong></td>
<td>Annually</td>
<td>-</td>
<td>E</td>
<td>At Laboratory</td>
<td></td>
</tr>
<tr>
<td><strong>Portable Thermometer</strong></td>
<td>With 10 Years Intervals / Together with the 2nd Special Survey.</td>
<td>Annually by Ship Between 0-100°C once at each degree.</td>
<td>A</td>
<td>At Laboratory with a reading of at least 0-100°C</td>
<td></td>
</tr>
<tr>
<td><strong>Measure Equipment Calibration Intervals</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Portable Pressure gauges</strong></td>
<td>With 10 Years Intervals / Together with the 2nd Special Survey.</td>
<td>Annually by Ship Between 0-25°C once at each bar.</td>
<td>B</td>
<td>At Laboratory with a reading of at least 0-25 Bar</td>
<td></td>
</tr>
<tr>
<td><strong>Portable Vacuum gauges</strong></td>
<td>With 10 Years Intervals / Together with the 2nd Special Survey.</td>
<td>Annually by Ship Between 0-(-1) once at each bar.</td>
<td>C</td>
<td>At Laboratory with a reading of at least 0-(-1) Bar</td>
<td></td>
</tr>
<tr>
<td><strong>Reference Thermometer</strong></td>
<td>With 10 Years Intervals / Together with the 2nd Special Survey.</td>
<td>-</td>
<td>A</td>
<td>At Laboratory</td>
<td></td>
</tr>
<tr>
<td><strong>Reference Pressure and vacuum Gauges</strong></td>
<td>With 10 Years Intervals / Together with the 2nd Special Survey.</td>
<td>-</td>
<td>B and C</td>
<td>At Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

**ACCEPTANCE CRITERIA**

A) The Equipment will be replaced if the difference exceeds 5°C with the reference thermometer
B) The Equipment will be replaced if the difference exceeds 3 Bar with the reference Pressure Gauge
C) The Equipment will be replaced if the difference exceeds –0.5 Bar with the reference vacuum gauge.
D) The equipment will be calibrated if the difference exceeds 5 cm.
E) The equipment will be calibrated if the LEL error exceed %2.

**Purging (to purge with routine air) the Instruction to use the Routine Diagramm.**

To purge the Cargo cofferdam pumps with air is a important function for the cargo pumps. Since this is the one method to check whether cargo or oil is leaked into the pump cofferdam from the leakage protecting pump seals. It is not avoidable that cargo will enter in the hydrolic line should you not purge within the intervals mentioned on the diagram (GF-6.00 A).
Therefore purge the lines in intervals and fill the diagram. Keep the records in ships files and return one copy in one months intervals to the company.

Each row on the diagram means a full operation starting from loading the cargo and completed upon completion discharging. Should some tanks be loaded and discharged much more than others fill an additional diagram.

The diagram is devided in different purging operations.

1. Before Loading
   - No leakage, insert the date and insert OK at the Result column.
   - Leakage, insert the date and mention the type of leakage. (1 H for 1 liter Hydrolic Oil, 1 C for 1 liter cargo.)
2. 1-2 Days After Loading - No Leakage; No leakage, insert the date and insert OK at the Result column. It is not necessary to purge. But for long voyages purge minimum in four days intervals.  
- Leakage; purge with minimum one week intervals For long voyages insert also the average leakage.

3. Before Discharging  
- No leakage, insert the date and insert OK at the Result column.  
- Leakage; insert the date and insert the type and quantity.

CHAPTER 8

HEALTH AND SAFETY PROCEDURE

8.1. **General**

Master is directly responsible from the implementation of company health and safety and health policy on board. To maintain and keep a hygienic environment on board is the main policy of the company. Master should regularly (at least every month) check accommodation and kitchen parts, report necessary precautions and requirements to the company and ensure the implementation of those. Chief officer by checking kitchen every day will maintain hygiene and order. According to this, the printed form, prepared by company, will be filled monthly and be kept in its relevant file. Keeping this record is the responsibility of Chief Officer.
Furthermore, master is responsible for keeping shipboard medical locker full and tidy. 3rd Officer is the health officer of the vessel but, when master thinks necessary he may appoint another officer as health officer. Health officer will keep the records of hospital regularly. These records are the monthly inventory and check lists’ results and the records of the medicine that delivered. The medical locker should be organised to allow any medicine to be located with the minimum of time. This may be accomplished by organising the medicines alphabetically by generic name or in their constituent groups using letters or using their IMGS number and storing them in numerical order. In either case full list of the medicines carried must be available detailing there position of storage.

Ship “Poison Chest” will be regularly checked and required medicines by informing the company will be provided. Also, master is responsible for posting all the necessary notification and explanatory information on board. Before carrying dangerous cargoes by making a safety meeting, chief officer will give necessary information to crew about handling of the cargo. Before embarkation to vessel and at least twice a year (every 6 month) shipboard personnel must have a drug and alcohol test in a contracted laboratory ashore. Moreover master, without notifying, takes urea sample for drug test (not exceeding 6 months). This control is implemented by sending the samples in a bottle to the laboratory by agent. This control can be made before arriving port or at the port. The results of the test will be filed on board and a copy will be sent to the company. From time to time an alcohol test can be made by using alcohol test equipment without notifying crew and results will be recorded to “DRUG AND ALCOHOL RECORD BOOK”. When required by port authorities, state surveyors and major companies’ inspectors, relevant files and record books will be presented and company drug and alcohol policy will be posted at bridge, alleyways and engine control room. When a member of crew disembarks the vessel his “health report” will be sent to the company.

8.2. Accident Investigation and Reporting Procedure

As indicated in Shipboard Safety Management Manual Chapter 9, all accidents, incidents and near misses must be reported to the company. Chief officer is Accident Prevention Officer on board. In any accident/incident situation ship management team (master, chief engineer, chief officer, 1st engineer) and safety officer come together and make a committee. This committee inspects the accident/incident and determines the reasons, responsibilities and necessary precautions to avoid the recurrence of the situation. After that a printed form of company will be filled and a copy of this form will be sent to the company. As indicated in Shipboard Safety Management Manual Chapter 12 this form will be used at master review.

Records of accidents are maintained in the following categories:
- Lost time
- Non - lost time

A lost time accident is one where the injured person is absent from duty as a result of his injuries for more than one watch or half a working day.

A non – lost time accident is one where an injured person was able to return to his duties or was not absent from duty as a result of his injuries for more than one watch or half a working day.

This situation (lost time or non – lost time) must be indicated in the relevant report.

How to report a major accident is explained in Ship Emergency & Contingency Manual.

CHAPTER 9

HELCIPOINT OPERATIONS PROCEDURE

9.1. General

Transfer of personnel or stores to or from the Company’s ships by helicopter must be conducted according to the safety standards published by the International Civil Aviation Organisation (ICAO) and any relevant national safety standards or operating safety procedures as outlined by the contracted helicopter company.

The most important factor in the successful conduct of safe helicopter operations is good communications. This means full understanding and agreement on a clear and simple plan both prior to and during operations between the ship’s Master and the helicopter pilot.

9.2. Responsibilities
The Master is responsible for the overall safety of the ship and has the authority to stop or cutrail operations at any time for reasons of ship safety. Clearance for a specific helicopter operation is given at the discretion of the Master.

The helicopter pilot is responsible at all times for the safety of the helicopter. In order to carry out their respective responsibilities the helicopter pilot and the ship’s Master must agree on the proposed operation before it is implemented.

Detailed instructions relating to Helicopter / Ship Operations are contained in the International Chamber of Shipping “Guide to Helicopter / Ship Operations” publication.

CHAPTER 10

EMERGENCY SHUT DOWN PROCEDURES

EMERGENCY SHUT DOWN PROCEDURES FOR CARGO PUMPING SYSTEM

In the event of an accidental overflow during discharge the vessel’s cargo pumps can be shut down by use of market “Emergency Shut down stations” located in the cargo area.

SHUT DOWN PROCEDURE
In the event of an emergency that requires the shut down of the cargo pumping system, the Officer on duty shall press the nearest emergency stop and signal the watching and the ships cargo manifold to close the valves of all tanks being currently discharged. Via radio he shall advise the shore contact person immediately and inform him of the shut down. It is important to close all cargo valves to prevent cargo from shore tanks flowing back to the vessel, or that vessels tanks are siphoned. Log entries shall be made of such downs and if any cargo was spilled, the applicable notification procedures shall be adhered to. In addition to the official reporting an incident report shall be filled out as required by company procedures.

CHAPTER 11
SLOP DISPOSAL PROCEDURE

11.1. MARINE POLLUTION PROCEDURE

11.1.1 GENERAL:

Activities and training concerning the prevention of marine pollution on board described thereunder shall be conducted in accordance with this Procedure and the requirements of the MARPOL Convention.

(1) Prevention of oil pollution
(2) Disposal of waste oils and sludges
(3) Disposal of sewage
(4) Disposal of waste

11.1.2. SHIP SYSTEM FOR ACTIVITIES TO PREVENT MARINE POLLUTION:

Shipboard system for preventing marine pollution during navigation shall consist of the following except in an emergency or specified circumstances, in particular, by the Master.

Person responsible overall Person responsible for management Person responsible for operations Assistant for operations
Disposal of engine room bilge Master C/E 1/E Oiler
Disposal of waste oils and sludges Master C/E 1/E Oiler
Disposal of sewage Master C/O Duty officer Duty AB
Disposal of waste (plastics) (landing) Master C/O Bosun Able seaman
Disposal of waste (plastics) (incineration) Master C/E 1/E Oiler
Disposal of waste (general) Master C/O Bosun Able seaman
Disposal of waste (foods) Master C/O Steward Cook
Disposal of Engine Room Bilge

Engine room bilge shall be disposed of in accordance with the instructions of the Chief Engineer. Oily water separator shall be operated only by the 1st Engineer or under his direct supervision. Overboard discharge valves for bilge shall be open/closed only by the First Engineer or under his direct supervision. Bilge may be discharged overboard only under the following conditions (discharge in accordance with Regulation 9, Annex I, MARPOL).

1. That the ship is in sea areas other than special areas (Mediterranean, Black Sea, Red Sea, Gulf Sea, Bay of Aden).
2. That the ship is proceeding enroute.
3. That oil content in bilge is not exceeding 15 ppm or less.
4. That an oil discharge monitoring and control system is under automatic operation.

Disposal of bilge shall be recorded in the Oil Record Book and the Chief Engineer and the Master shall verify it. The Oil Record Book shall be entered in accordance with the procedures specified in Article 20, Annex I and Appendix 3 of MARPOL.

Engine room bilge shall be disposed of in accordance with the procedures described hereunder.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Operation time</th>
<th>Operator Record</th>
<th>Verified by</th>
</tr>
</thead>
<tbody>
<tr>
<td>*soundings</td>
<td>at 0800 everyday / oiler</td>
<td>Eng. Sounding note</td>
<td>C/E</td>
</tr>
<tr>
<td>*operation of oily water separator</td>
<td>To be decided by C/E-1E</td>
<td>Oil Rec.Book.</td>
<td>C/E &amp;Master</td>
</tr>
</tbody>
</table>

Oily water separator shall be operated in accordance with the following procedures.

<table>
<thead>
<tr>
<th>Item</th>
<th>When to be carried out</th>
<th>Person in charge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Checks of alarm(*1)</td>
<td>Before operation</td>
<td>1/E</td>
</tr>
<tr>
<td>Checks of oil content meter(*2)</td>
<td>“</td>
<td>1/E</td>
</tr>
<tr>
<td>Checks of overboard discharge valves (closed)(*3)</td>
<td>“</td>
<td>1/E</td>
</tr>
<tr>
<td>Checks state of navigation route and position(*4)</td>
<td>“</td>
<td>1/E</td>
</tr>
<tr>
<td>Operation of oily water separator(*5)</td>
<td>“</td>
<td>1/E</td>
</tr>
<tr>
<td>Overboard discharge(*6) operation</td>
<td></td>
<td>1/E</td>
</tr>
</tbody>
</table>

*1: Checks of operation of oil discharge monitoring and controlling system.
*2: Checks of the indication shown with fresh water.
*3: Checks of the indication shown
*4: Lock up while in a port.
*5: Establish shipboard circulating lines and operate bilge pumps
*6: Open overboard discharge valves after confirming the indication of the oil content meter.

** During operation of oily water separator, the oil content in discharge water shall be checked appropriately from the deck. While the oily water separator is operating, the oil discharge monitoring and control system shall be under automatic operation.

11.1.3. DISPOSAL OF WASTE OILS & SLUDGES:

Waste oil and sludges generated in the engine room shall, in principle, be incinerated. Materials which are not allowed to incinerate shall be landed for disposal in accordance with the procedures below.

Transfer to the dry dock
The Chief Engineer shall submit an application for the disposal of sludges and bilges to the Manager of the Ship Maintenance Division when dry-docking.
A transfer certificate shall be obtained and retained with the Oil Record Book.

Transferring at a port of entry
When transferring waste oils and sludges at a port of entry, it shall be conducted in accordance with the procedures below.
An application covering the following shall be submitted to the Manager of the Marine Division at least one week before arrival.
1. Quantity of waste oils and sludges to be landed.
2. Examination of whether or not waste oils and sludges can be discharged up to the ship side with the ship's sludge pump.
3. Remaining storage capacity of sludge tanks.
4. Heating temperature of sludges.
5. Urgency of landing and reason.
6. Other necessary matters.

The Company will arrange a contractor for landing and agent at the port of entry and inform them to the ship.

11.1.4. MONITORING OIL SPILLS:

While at sea, the equipment below shall be monitored regularly for oil leakage and the results shall be entered in the engine log book.
1. Stern tube oil seal system
2. Void spaces
3. Machinery on deck (winch, windlass, cargo gear)
4. Air vent system of each oil tank
   * Presence of contamination with oil on the sea surface at the stern shall be checked once a day.

While in port, oil spill monitoring for the following shall be conducted once a day and the results shall be entered in the Port Log.
1. Sea surfaces at ship side.
2. Lubricating oil leakage at machinery and equipment on deck.
3. Presence of oil in spill tank for air vents of each oil tank.

11.1.5. DISPOSAL OF SEWAGE:

Sewage produced on board shall be disposed of in accordance with the procedures below corresponding to Annex IV of MARPOL.
The First Engineer shall be responsible for managing sewage disposal.
Sewage produced on board shall be disposed of in the sewage treatment plant.
While a ship is in port, sewage on board shall be kept in a holding tank of the sewage treatment plant and discharge overboard is prohibited.
Overboard discharge from sewage treatment plant shall be conducted under the conditions below under the responsibility of a watchkeeping engineer and the time of commencement and the position of discharge shall be entered in the engine log book.

1. Ship is four miles or more from the nearest land.
2. Ship's speed is four knots or more.

Overboard discharge of sewage shall, in principle, be performed through the sewage treatment plant, however, if it is discharged overboard directly for some reason, it shall be under the conditions below under the responsibility of the First Engineer and the time of commencement and the position of discharge shall be entered in the engine log book.
(1) A ship is 12 miles or more from the nearest land.
(2) Ship's speed is four knots or more.

Procedure for Disposing of Waste on Board
Waste produced on board shall be disposed of in accordance with this Procedure by observing Annex V of MARPOL. Waste shall be separated into plastic waste, garbage and general waste and shall be disposed of in accordance with the respective procedures.

Plastic Wastes
The following plastic products are defined as plastic waste.
(1) Synthetic fibre ropes and their products (net slings etc.)
(2) Plastic bags and packing materials
(3) Foam styrene
(4) Other plastic products

Dumping of plastic waste at sea is prohibited in any form.
Disposal method shall, in principle, be incineration on board.
Incineration on board shall be conducted under the responsibility of the Chief Engineer.
Materials that cannot be incinerated shall be cut into small pieces and stored on board, and landed for disposal.
Boatswain shall manage materials stored on board.
The Chief Officer shall perform disposal by landing and obtain the signature of the receiving contractor on a Garbage Note.

11.1.6. GENERAL WASTE:
The following waste is defined as general waste and shall be disposed of in accordance with this Procedure.
(1) Paper products and cloths
(2) Glass, bottles and metals
(3) Woods and wood products
(4) Porcelains

General waste shall, in principle, be incinerated on board (person responsible for incineration is the Chief Engineer). Boatswain shall have the responsibility for collecting and managing waste.
Materials that cannot be incinerated shall be disposed of by dumping them into the sea under the conditions below and under the supervision of the Chief Officer after obtaining of the approval of the Master.
Materials such as dunnages and packing, which float, shall be disposed of by dumping into sea areas 25 miles or more from the nearest land where there are no ships navigating and fishing vessels operating. Also, the sea area where waste is dumped shall be selected with consideration given to the current so that dumped waste does not drift to a neighbouring shore.
General waste other than the above shall be cut into as small pieces as possible and dumped into sea areas 12 miles or more from the nearest land where there are no ships navigating and fishing vessels operating.
Dumping shall not be conducted in the following sea areas: Mediterranean, Baltic Sea, Black Sea, Red Sea, Gulf Sea area, North Sea, Antarctic Sea areas, the Caribbean Sea (refer to Annex V of MARPOL for details).
When dumping into the sea, the dumping time and position, name and quantity of materials dumped etc. shall be entered in the ship's log book.
Procedure for Disposing of Garbage;
Food waste from the pantry shall be disposed of in accordance with this Procedure.
Food waste produced in port shall be stored on board. When staying in port for a long period, it shall be landed for disposal at the judgement of the Master. In such a case, the landing procedure is the same as that for plastic waste.

While a ship is navigating in a sea area three miles or less from land, inland water, or strait, waste shall be stored on board or disposed of by incineration.
While a ship is navigating in sea areas other than the sea areas in , waste shall be disposed of with disposers.

11.1.7. MAINTAINCE & PREPARATION OF EQUIPMENT FOR PREVENTING MARINE POLLUTION:
Oily bilge produced in the engine room is pumped out from bilge tanks and sent to a bilge separator. Water with oil content removed by this bilge separator shall be measured for its oil content and discharged overboard only when the oil content in the bilge is 15 PPM or less. It is essential to restrict the oil content in the bilge discharged overboard to as low a level as possible. The Chief Engineer shall, in principle, do the following maintenance and preparations for equipment.
Equipment | Contents of maintenance and preparation
---|---
(1) Filters on sistem | Overhauling and cleaning up weekly
(2) Bilge separator | Overhauling every six months
| For Coalesce, renewal once a year
(3) Oil content meter | Cleaning with fresh water and testing alarm after every use.
| Cleaning sensor every three months and maker's maintaince once every five years
(4) Automatic discharge control valves | before operation, every use

Special procedures for entering the Black Sea

All Masters must be aware of the fact that there are special procedures to enter the Black Sea through the Dardanels/Bosporus channels.

The following steps must be taken prior to the vessel entering the Black Sea:
(i) all clean and segregated ballast water must be discharged prior to entering the Dardanels and new clean ballast must be taken in the Black Sea
(ii) sewages are to be discharged into appropriate tanks or ashore. The sewage system must be emptied and cleaned, and all sewage outlets must be locked to avoid discharge of sewage into the sea. Where applicable, chemical toilets are to be used
(iii) engine room bilges must be discharged prior to entering the Black Sea. If discharged ashore, the relevant certificate of discharge must be available on board. The Oil Record Book must be correctly filled and updated. ODM discharge into the Black Sea is prohibited
(iv) for what concerns the discharge of ......................... (f.e.: solid garbages, noxious substances) consult Annex ...... and Annex ...... of Marpol 73/78 as amended, for traffic in Special Areas.

Prohibitions and restrictions are applicable until the vessel sails back out of Black Sea waters.

11.1.8. MAINTAINCE & PREPARATION OF TREATMENT AGENT:

The Chief Officer shall check the retention of treatment plant and materials to be used for overboard discharge of oil (oil neutralization agent, sawdust, waste, oil fences (for tankers only)) specified in the Shipboard Oil Pollution Emergency Plan (SOPEP) every month. When they are consumed, they shall be replenished to maintain the specified quantities.

11.2. OIL SPILL CONTINGENCY PROCEDURES

11.2.1. GENERAL:

Scope
The following two cases are presumed as oil spill contingencies on a ship and the basic procedures for responding to these contingencies are shown. Other oil spill contingencies are to be handled on a case-by-case basis measures corresponding to this Procedure and the Shipboard Oil Pollution Emergency Plan for restricting expansion of the contingency and to minimize marine pollution.
(1) Oil spill contingency while a ship is in port
(2) Oil spill contingency while a ship is at sea

Types of Contingency
The following cases are anticipated as oil spill contingencies.
(1) Spillage when bunkering fuel oil and loading lubricating oil.
(2) Spillage from stern tube bearing system.
(3) Spillage of grease, lubricating oil and hydraulic oil from machinery on deck.
(4) Spillage from oil tanks due to hull damage.
As there are many contingencies for oil spills, as shown above, all crew members shall respond quickly to various oil spill contingencies in accordance with this Procedure and the Shipboard Oil Pollution Emergency Plan to minimize pollution.

11.2.2. PROCEDURES FOR RESPONDING TO CONTINGENCIES:

While a Ship is in Port

When a person discovers an oil spill, he shall immediately report it to a watchkeeping officer, the Chief Officer or the Chief Engineer. The Master or his representative shall take measures in accordance with the following. It shall be immediately informed on board over the public address system or verbally, and the Oil Spill Emergency Station shall be ordered to take action. The crew shall immediately suspend their current duties and go to the specified station. In this case, the following operations shall be suspended until the Master gives instructions.

1) Cargo operation
2) Loading of ship's stores etc.
3) Maintenance and repair work for the ship
4) Preparation of food

The Chief Engineer shall define the oil spill point, investigate the cause, direct the preventive operation for oil spill and estimate oil quantity spilled overboard, and report the results to the Master. The Chief Officer shall direct the operation to prevent the expansion of spilled oil. He shall make a prompt judgment as to whether the ship's crew can respond and the equipment and materials on board or not and report the results to the Master (when the Master is absent from the ship, he shall report to the agent and ask for assistance). The 3rd Officer shall confirm wind direction, wind speed, and tide, and report them to the Master and the Chief Officer. The Master shall report to the following organizations after confirming the reports from the Chief Engineer and the Chief Officer and also the site.

1) Harbour Master
2) Maritime Safety Agency
3) Agent
4) The Company.
5) P&I representative

All crew members shall carry out the duties listed in the Oil Spill Emergency Station and described in the Shipboard Oil Pollution Emergency Plan.

The Master may release part or all of the Oil Spill Emergency Station depending on the situation. Oil Spill Emergency Station

The emergency station responding to oil spill shall, in principle, be that listed in the Oil Spill Emergency Station, which is described in the Shipboard Oil Pollution Emergency Plan, however, notwithstanding the above station, the Master may establish a station which is appropriate in his judgment with consideration given to the number of crew, their abilities, etc. A general emergency station is shown below.

11.2.3. GUIDANCE FOR TREATING OIL SPILL:

Optimum method shall be applied to the treatment of spilled oil depending on the conditions, and it shall be conducted in accordance with the guidance below.

Preventing the Expansion of Spilled Oil

1) Extending oil fences (requesting oil supply boats).
2) Extending roll-mats or oil absorbing sheet-mats.
3) Preventing expansion by spraying water at the oil boundary.
4) Setting buoys at oil boundary.

Recovery of Spilled Oil

1) Recovery with oil absorbing mats.
2) Scooping with scoops, buckets etc.
3) Preventive measures on board for further spills.

Treatment of the Oil Not Recovered
Efforts shall be made to recover as much spilled oil as given possible. The remaining oil shall be treated with attention given to the following.

(1) Apply oil treatment agents after confirming permission their use.
(2) As some oil absorbing materials lose their oil absorbing effect when applying oil treatment agents, the oil treatment agents shall be applied last.
(3) Appropriate quantity (restricted to minimum quantity) of the oil treatment agents shall be dispersed from the wind side.

11.3. BUNKER / OIL TRANSFER PROCEDURE

11.3.1. GENERAL:

Scope
Procedures for receiving and transferring between tanks of fuel oil and lubricating oil on a ship shall, in principle, be in accordance with the following, however, this may be revised depending on the conditions of the individual ships. Procedure for receiving and transferring between tanks of lubricating oil shall correspond to the following procedure for fuel oil.

Procedures and Basic Matters for Receiving Fuel Oil
Preparations on board
(1) Preparations and dissemination of job distribution.
(2) Preparation and posting of piping diagram. Piping diagram shall be concise and legible. Pipes and valve shall be clearly distinguished.
   *During bunkering, the piping diagram shall be located near the operating valves to prevent incorrect valve operation.
Operating valves
(3) Prepare operating procedures of the ship in accordance with the standard for operation procedures.
(4) Conduct pressure leak test for bunkering lines. (to be conducted with an air pressure equivalent to the maximum operating pressure of the piping) (once every six months)
   * Test records shall be retained.

Standard operating procedure
Fuel oil shall be received in accordance with the standard operating procedure below and shall be verified at each stage by each person responsible. The operation shall be carried out in accordance with the table of job distribution.

11.4. BUNKERING OPERATION DESIGNATION

CHF ENGINEER : RESPONSIBLE AND ORGANIZATOR FROM ALL BUNKERING OPERATION.

II. ENGINEER : RESPONSIBLE FROM HOSE CONNECTION AND MANIFOLD VALVES CONTROL.

III. ENGINEER : RESPONSIBLE FROM REPORTING TO CHIEF ENGINEER AND PREPARATION THE BUNKERING CHECK LIST.

IV. ENGINEER : RESPONSIBLE FROM LINE PREPARATION AND BUNKERING OPERATION. LOADING QANTITY WILL BE CHECKED AND FILLED TO LOG BOOK BY HIM, END OF THE BUNKERING OPERATION.

ELECTRICIAN : WILL ASSISTANCE TO III. ENGINEER.
DONKEYMAN : WILL ASSISTANCE TO II.ENGINEER.

FITTER : WILL ASSISTANCE TO III ENGINEER

OILER : WILL ASSISTANCE TO IV.ENGINEER

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IMPORTANT NOTE: COMPLETION OF THE BUNKERING OPERATION ,ALL TRAY MUST BE CLEAN AND BUNKER HOSES MUST BE BLANKET WITH BLANK FLECH WITHOUT POLLUTION (ALL FLENCHES WILL BE FULLY BOLTED.) AFTER COMPLETION OF SECURING SITUATION MUST BE REPORTED TO THE CHIEF ENGINEER AND THE CHIEF OFFICER.

CHIEF ENGINEER
MASTER

11.5.BUNKER SAMPLING PROCEDURE

The Company establishes that bunker samples are always to be taken.(or.: When deemed necessary, taking into account the quality of the previous supplies or any other reason, the Company may require the Chief Engineer to take bunker samples.)

To avoid accidents or pollution, the following procedure must always be complied with:

(i) let the bunker drip continuously into one drum placed under the drip tap on the manifold, during all bunkering operations
(ii) collect 3 samples of 1 litre each from this drum
(iii) samples sealed and labelled with the date and place of delivery are to be signed by the Chief Engineer and bunker Supplier Representative who will keep one sample
(iv) the remaining 2 samples shall be stored on board for one year, ready for analysis to be carried out in the case of claims or other problems.

Bunker must always be received, if feasible, into empty tanks. This practice has the following advantages:
(a) possibility of segregating different bunkers giving problems
(b) avoidance of compatibility problems arising from different bunkers.

ANNEX 2

INTRODUCTION

1. The International Convention for the Prevention of Pollution from ships, 1973, as modified by the protocol of 1978 relating there to (here in after referred to as MARPOL 73/78) was established in order to prevent the pollution of the marine environment by discharges into the sea from ships of harmful substances or effluents containing such substances or effluents containing such substances. In order to achieve its aim, MARPOL 73/78 contains five Annexes in which detailed regulations are given with respect to the handling on board ships and the discharge into the sea of five main groups of harmful substances, i.e.

Annex I (mineral oils), Annex II (liquid noxious substances carried in bulk), Annex III (harmful substances carried in packed forms), Annex IV (sewage), Annex V (garbage), Annex VI (air pollution)

2. Regulations 5 of Annex II prohibits the discharge into the sea of noxious liquid substances of categories A, B, C and D or of ballast water, tank washings or other residues or mixtures containing such substances, except in compliance with specified conditions including procedures and arrangements based upon standards develop by The International Maritime Organisation (IMO) to ensure that criteria specified for each Category will be met.
3. The standards for Procedures and Arrangements called for by Annex II of MARPOL 73/78 (as referred above) require that each ship which is carriage of noxious liquid substances in bulk shall be provided with a Procedures and Arrangement Manual.

4. The manual has been written in accordance with chapter 2 of the standards and is concerned with the marine environmental aspects of the cleaning of cargo tanks and the discharge of residues and mixtures from these operations. The manual is not a safety guide and reference should be made to other publications specifically to evaluate safety hazards.

5. The purpose of the manual is to identify the arrangements and equipment required to enable compliance with Annex II and identify the ships officers all operational procedures with respect to cargo handling, tank cleaning, slop handling, residue discharging, ballasting and deballasting, which must be followed in order to comply with the requirements of Annex II.

6. In addition this manual together with the ships Cargo Record Book and Certificate of fitness issued under the International Bulk Chemical Code, will be used by Administration for control purpose in order to ensure full compliance with the requirements of Annex II by the ship.

7. The master shall ensure that no discharges into the sea of cargo residues or residue/water mixtures containing Category A, B, C or D substances shall take place, unless such discharges are made in full compliance with the operational procedures contained in this manual and that the equipment required by this manual and needed for such discharges is used.

8. This manual has been approved by the Administration and no alteration or revision shall be made to any part of it without the prior approval of the Administration.

SECTION 1  MAIN FEATURES OF MARPOL 73/78, ANNEX II

1.1 The requirements of Annex II apply to all ships carrying noxious liquid substances in bulk. Substances posing a threat of harm to the marine environment are divided into four categories A, B, C and D and listed such in Appendix II to Annex II. Category A substances are those posing the greatest threat to the marine environment, whilst Category D substances are those posing the smallest threat.

1.2 Annex II prohibits the discharge into the sea of any effluent containing substances falling under these Categories, except when the discharge is made under conditions which are specified in detail in each Category. These conditions include, where applicable, such parameters as:
   - The maximum quantity of substances per tank which may be discharged into the sea;
   - The speed of the ship during discharge;
   - The minimum distance from the nearest land during discharge;
   - The minimum depth of water at sea during discharge;
   - The maximum concentration of substances in the ship's wake or the dilution of substances prior to discharge; and
   - The need to effect the discharge below the water line.

1.3 For certain sea areas identified as “special areas” more stringent discharge criteria are given. Under Annex II the special areas are the Baltic Sea area*, the black sea area and the Antarctic area**.

1.4 Annex II requires that every ship is provided with pumping and piping arrangements to ensure that each tank designated for the carriage of Category B and C substances does not retain after unloading a quantity of residue in excess of the quantity given in the Annex for each tank intended for the carriage of such substances. An assessment of the residue quantity has to be made. Only when the residue quantity as assessed is less than the quantity prescribed by the Annex may a tank be approved for the carriage of a Category B or a Category C substance.

1.5 In addition to the conditions referred to above, an important requirement contained in Annex II is that the discharge of certain cargo residues and certain tank cleaning and ventilation operations, may only be certain tank cleaning and ventilation operations, may only be carried out in accordance with approved procedures and arrangements based upon standards developed by the International Maritime Organisation (IMO).

1.6 To enable this requirement to be complied with this manual contains in Section 2 all particulars of the ships equipment and arrangements in Section 3 operational procedures for cargo unloading and tank stripping and in Section 4 procedures for discharge of cargo residues, tank washing slop collection, ballasting and deballasting as may be applicable to the substances the ship is certified to carry.

1.7 By following the procedures set out in this manual it will be ensured that the ship complies with all relevant requirements of Annex II to MARPOL 73/78.
NOT: MARPOL 73/78, Annex defines these areas as follows:

* The Baltic Sea Area means the Baltic Sea proper with the Gulf of Bothnia, the Gulf of Finland and the entrance to the Baltic Sea bounded by the parallel of the Skaw in the Skagerrak at 57° 44.8′ N.

** The Black Sea Area means the Black Sea proper with the boundary between the Mediterranean and the Black Sea constituted by the parallel 41° N.

The Antarctic area means the sea area south of latitude 60° S.

SECTION 4 PROCEDURES RELATING TO CLEANING OF CARGO TANKS, THE DISCHARGE OF RESIDUES

4.1 This section contains a description of the operational procedures in respect of tank cleaning, ballast and slops handling which must be followed in order to ensure compliance with the requirements of Annex I.

4.2 The following paragraphs outline the sequence of actions to be taken and contain the information essential to ensure that noxious liquid substances being discharged without posing a threat of harm to the marine environment.

4.3 Establish if the last cargo in the tank is included in the ship's approved list of noxious liquid substances (see table 1). If not included no special tank cleaning, residue discharge, ballasting and deballasting procedures apply under the provisions of Annex II.

4.4 If the last cargo in the tank is included in the above mentioned list, the information necessary to establish the procedures for discharging the residue of that cargo, cleaning, ballasting and deballasting the tank, should take into account the following:

4.4.1 Category of substances

Obtain the category of the substance from the table.

4.4.2 Stripping efficiency of tank pumping system.

The stripping quantity in tank and its piping system should not exceed 0.1 m³.

4.4.3 Vessel within or outside special area

4.4.3.1 Tank washing and residue discharge procedures for Category A substances outside special areas

Annex II requires that when a cargo tank that has contained Category A substance is washed, the resulting residue/water mixtures be discharged to a reception facility until the concentration of the substance in the effluent is at or below a specified value and until the tank is empty. Where it is found to be impracticable to measure the concentration of the substance in the effluent, a prewash procedure in accordance with addendum B should be applied in conformity with regulation 8(4). The residue/water mixture generated during the prewash should be discharged to a reception facility in accordance with regulation 8.

Any water subsequently introduced into the cargo tank may be discharged into the sea according to the following requirement (regulation 5(1)).

The discharge into the sea of the substances in category A or ballast water, tank washings or other residues or mixtures containing such substances shall be prohibited. If tanks containing such substances or mixtures are to be washed the resulting residues shall be discharged to a reception facility at or below 0.1% by weight and until the tank is empty. Any water subsequently added to the tank may be discharged into the sea when all the following conditions are satisfied:

- the ship is proceeding en route at speed of at least 7 knots.
- the discharge is made below the water line, taking into account the location of the seawater intakes; and
- the discharge is made at a distance of not less than 12 nautical miles from the nearest land in a depth of water of not less than 25 m.

4.4.3.2 Tank washing and residue discharge procedures for Category A substances within special areas

Annex II requires that when a cargo that has contained a Category A substance is washed, the resulting residue/water mixtures must be discharged to a reception facility until the concentration of the substance in the effluent is at or below a specified value and until the tank is empty. Where it is found to be impractical to measure the concentration of the substance in the effluent, a prewash procedure in accordance with addendum B should be applied in conformity with regulation 8(4).
The residue/water mixture generated during the prewash should be discharged to a reception facility in accordance with regulation 8.

Any water subsequently introduced into the cargo tank may be discharged into the sea according to the following requirement (regulation 5(7)). The discharge into the sea of substances in Category A or ballast water tank washings, or other residues or mixtures containing such substances shall be prohibited. If the tanks containing such substances or mixtures are to be washed the resulting residues shall be discharged to a reception facility which the states bordering the special area shall provide in accordance with regulation 7 of Annex II until the concentration of the substance in the effluent to such facility is at or below 0.05% by weight and until the tank is empty. Any water subsequently added to tank may be discharged into the sea when all the following conditions are satisfied:

- the ship is proceeding en route at a speed of at least 7 knots;
- The discharge is made below the water line, taking into account the location of the sea water intakes; and
- The discharge is made at a distance of not less than 12 nautical miles from the nearest land and in a depth of water of not less than 25 m.

4.4.3.3 Discharge from a slop tank for Category A substances

Any residues retained on board in a slop tank, including those from cargo pump room bilges, which contain a Category A substance shall be discharged to reception facility in accordance with the provision of last paragraph of 4.4.3.1 and 4.4.3.2 whichever is applicable.

4.4.3.4 Tank washing and residue discharge procedures for category B substances outside special areas

High-viscosity or solidifying substances

A prewash procedure as specified in Addendum B should be applied; The residue/water mixture generated during the prewash should be discharged to reception facility in accordance with regulation 8.

Any water subsequently introduced into the cargo tank may be discharged into the sea at a rate not exceeding the maximum rate for which the underwater discharge outlet is designed. The ship must be more than 12 nautical miles off land, proceeding en route at a speed of 7 knots or more and depth of water not less than 25 m.

Low-viscosity, non-solidifying substances

Any water subsequently introduced into the cargo tank may be discharged into the sea at a rate not exceeding the maximum rate for which the underwater discharge outlet is designed. The ship must be more than 12 nautical miles off land, proceeding en route at a speed of 7 knots or more and depth of water not less than 25 m.

High viscosity substances: High viscosity substances means for noxious liquid substances in category B and noxious liquid substances in category C which are unloaded in special areas, a substance whose viscosity at cargo unloading is 25 mPas or more, and for noxious liquid substances in category C which are unloaded outside special areas, a substance whose viscosity at the cargo unloading is 60 mPas or more.

Solidifying substances: Solidifying substances means for noxious liquid substances with melting point lower than 15 C, a substances whose temperature at cargo loading is higher by less than its own melting point; and for noxious liquid substance whose temperature at cargo unloading is higher by less than 10 C than its own melting point.

Non-solidifying substances: Non-solidifying substances means a noxious liquid substance other than solidifying substances.

Low viscosity substances: Low viscosity substances means a noxious liquid substances other than high viscosity substances.

4.4.3.5 Tank washing and residue discharge procedures for category B substances within special areas

A prewash procedure as specified in Addendum B should be applied. The residue/water mixture generated to a reception facility in accordance with regulation 8.

Any water subsequently introduced into the cargo tank may be discharged into the sea at a rate not exceeding the maximum rate for which the underwater discharge outlet is designed. The ship must be more than 12 nautical miles off land, proceeding en route at a speed of 7 knots or more and depth of water not less than 25 m.

Notwithstanding the provision of paragraphs of 4.4.3.5 residue/water mixtures containing only low-viscosity, non-solidifying substances may be retained on board and discharged into the sea outside special areas in accordance with the provisions of last paragraphs of 4.4.3.4 or 4.4.3.6

Note: Any discharge inside Antarctic area of category B noxious liquid substances or mixtures containing such substances is prohibited.

4.4.3.6 Discharge from a slop tank for category B substances

Residue/water mixtures in slop tank should not be discharged into the sea within special areas.
Residue/water mixtures in a slop tank which contain only low-viscosity, low-solidifying substances may be discharged into the sea outside special areas at a rate not exceeding the maximum rate for which the underwater discharge outlet is designed. The ship must be more than 12 nautical miles off land, proceeding en route at a speed of 7 knots or more and depth of water not less than 25 m.

Residue water mixtures in slop tank which contain high viscosity or solidifying substances, retained on board in accordance with regulation 8, should be discharged to a reception facility.

4.4.3.7 Tank washing and residue discharge procedures for category C substances outside special areas

High viscosity or solidifying substances
A prewash procedure as specified in addendum B should be applied. The residue/water mixture generated during the prewash should be discharged to a reception facility in accordance with regulation 8.
Any water subsequently introduced into the cargo tank may be discharged into the sea at a rate not exceeding the maximum rate for which the underwater discharge outlet is designed. The ship must be more than 12 nautical off land, proceeding en route at a speed of 7 knots or more and depth of water not less than 25 m.

Low-viscosity, non-solidifying substances
Any water subsequently introduced into the cargo tank may be discharged into the sea at a rate not exceeding the maximum rate for which the underwater discharge outlet is designed. The ship must be more than 12 nautical off land, proceeding en route at a speed of 7 knots or more and depth of water not less than 25 m.

4.4.3.7 Discharges from a slop tank for category C substances

Residue/water mixtures in a slop tank which contain only low-viscosity, non-solidifying substances may be discharged into the sea at a rate not exceeding the maximum rate for which the underwater discharge outlet is designed. The ship must be more than 12 nautical off land, proceeding en route at a speed of 7 knots or more and depth of water not less than 25 m.

Residue/water mixtures in a slop tank which contain only high-viscosity or solidifying substances, retained on board in accordance with regulation 8, should be discharged to a reception facility.

4.4.3.10 Discharge of Category D residues

Discharge of category D residues to the sea is permitted if:
The residues are diluted by ten times their volume by water.
The ship is more than 12 nautical miles off land and proceeding en route at a speed of 7 knots or more.

4.4.4 Solidifying or high- viscosity substances

The properties of the substances should be obtained from the shipping document.

4.4.5 Miscibility in water

This property of the substance should be obtained from list of noxious liquid substances allowed to be carried.

4.4.6 Compatibility with slops containing other substances

Obtain it from compatibility guides. Please refer to documents of 46 CFR 150 of USCG on board for the compatibility guide. The residues not compatible must not be contained in the same slop tank.

4.4.7 Discharge to reception facility

The residue/water mixture of substances are given below generated during the prewash should be discharged to a reception facility before the vessel departs from the unloading port.
-All category A substances within and outside special areas.
-All category B substances within the special areas
-Category B high viscosity or solidifying substances outside special areas.
-Category C high viscosity or solidifying substances within special areas.
-Category C high viscosity or solidifying substances outside the special areas.

4.4.8 Discharging into the sea
Any discharge inside the Antartic area of any noxious liquid substances or mixtures containing such substances is prohibited.

4.4.8.1 Discharge from cargo tanks

Section 4.4.3 deals with the various factors governing the discharge of residue and residue/water mixtures from cargo tanks further reference is made to the flow diagram in addendum A.

4.4.8.2 Discharge from slop tanks

Reference is made to the flow diagram in Addendum A, as well in section 4.4.3 of this manual.

Any slop tank containing residues/water mixtures of category D substances may be discharged inside and outside special areas as specified in section 4.4.3.1

4.4.10 Use of cleaning agents or additives

When a cleaning agent (i.e. a solvent) that is a harmful substance as defined by either Annex I or Annex II of MARPOL 73/78 is used instead of water to wash a tank having contained a noxious liquid substance the discharge of that cleaning agent shall be governed by the restrictions of Annex I or Annex II that would apply as if that cleaning agent had been carried as cargo.

When small amounts of cleaning additives (i.e. detergents) are added to water to facilitate tank washing, no restrictions additional to those applicable to the tank due to previous cargo shall apply.

4.4.10 Use of ventilation procedures for the tank cleaning

When the ventilation procedures are used to remove residue from cargo tanks, the requirements set out below should be applied.

Ventilation procedures may be applied only to those substances having vapour pressure greater than 5x10^3 Pa at 20°C.

The ventilation procedures set out in appendix C should be followed when a tank is to be ventilated. When ventilating a tank, the associated piping of the tank should be cleared of liquid and tank should be ventilated until no visible remains of liquid can be observed in the tank. When direct observation is impossible or impracticable, means for detection of liquid remains should be provided.

APPENDIX A
FLOW DIAGRAMS

CLEANING OF CARGO TANKS AND DISPOSAL OF TANK WASHING / BALLAST CONTAINING RESIDUES OF CATEGORY A, B, C AND D SUBSTANCES
Note: The symbol CDP refers to the cleaning and disposal procedures given in the following page.

<table>
<thead>
<tr>
<th>PROCEDURES (CDP)</th>
<th>1(a)</th>
<th>1(b)</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5(a)</th>
<th>5(b)</th>
<th>6</th>
<th>7</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply prewash in accordance with Addendum B and discharge residue to reception facility</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apply prewash in accordance with Addendum B and transfer residues to slop tank for discharge to sea in accordance with chapter 10 section 10.5 or 10.6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apply ventilation procedures in accordance with Appendix C</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Residue may be retained on board and discharged outside special area | X
---|---
Residues of substances with viscosities < 60 m.Pa.s at the loading temperature may be retained on board and discharged outside special area. Alternatively, tanks may be prewashed and slops discharged ashore | X
Dilute residue in cargo tanks with water to obtain residue concentration in mixture of 10 % or less | X
Conditions for discharge of ballast/residue/water mixtures other than prewash:
- 12 miles from land
- 7 knot ship speed
- 25 meters water depth using underwater discharge | X X X X X X X X
Ballast tank or wash tank to commercial requirements. | X X X X X X X X
Alternatively, residue/water mixtures may be discharged ashore (N:B: optional not MARPOL requirement) | X X X X X X X X
Any water subsequently introduced into the sea without restrictions. | X X X X X X X X

NOTE: Start at the top of column under the CDP number specified and complete each procedure in sequence where marked X.
DISPOSAL OF PREWASH OR TANK WASHING CONTAINING CATEGORY A, B, C OR D SUBSTANCES FROM DEDICATED SLOP TANKS CONTAINING TANK WASHING OR SLOPS

Identify each category of slops in the tanks and from which tanks the slop originated

- Slop contain Cat A substance
  - yes → SDP 1 *
  - no → Slop contain Cat B substance
    - yes → disposal inside special area
      - yes → SDP 1 *
      - no → disposal outside special area
        - yes → solidifying or High viscosity substance
          - yes → SDP 1 *
          - no → SDP 4
    - no → Slop contain Cat C substance
      - yes → disposal inside special area
        - yes → solidifying or High viscosity substance
          - yes → SDP 1 * or SDP 4*
          - no → PSP 4
        - no → disposal outside special area
          - yes → solidifying or High viscosity substance
            - yes → SDP 1 *
            - no → SDP 4
      - no → Slop contain Cat D substance
        - yes → SDP 2 or Sdp 3
        - no → Discharge into the sea is Not regulated by Annex II

* Slops resulting from the subsequent washing of tanks which have been prewashed in accordance with addendum B may be discharged in accordance with SDP 4 provided they are not mixed with other slops requiring discharge in accordance with SDP 1 or 6

* Any disposal of noxious liquid substances as category A, B, C and D or mixtures containing such substances shall be prohibited when the vessel is inside antarctic sea.
**SLOPS DISPOSAL PROCEDURE**

<table>
<thead>
<tr>
<th>(SDP)</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slops must be discharged ashore</td>
<td></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Establish discharge rate of miscible residue/water</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>mixture in accordance with addendum D</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Divide obtained discharge rate of pure product by</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>composite slops concentration</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>The figure obtained shows the rate at which discharge</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>is permitted</td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residues of substances with viscosities &lt;60 mPa.s at</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>the unloading temperature may be retained on board</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>and discharged outside special area.</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Alternatively , tanks may be prewashed and slops discharged ashore</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dilute slops with water to obtain a solution of 10% or less no</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>restrictions on discharge rate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discharge rate is maximum permitted by underwater discharge outlet</td>
<td></td>
<td></td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Additional discharge conditions</td>
<td></td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>- ship’s speed at least 7 knots</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>- outside 12 miles from nearest land</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- depth water at least 25 m</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- using underwater discharge</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td>X</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Start at the top of column under the SDP number specified and complete each procedure in sequence where marked x.
ADDENDUM B

PREWASH PROCEDURES

1. General:

In sections 3 and 4 this manual the prewash programmes are specified in order to meet the requirements of Annex II. This addendum explains how these prewash programmes should be effected. Residue/water mixtures resulting from prewash programmes must be discharged to shore reception facilities prior the departure from the unloading from the unloading port.

Characteristics of washing system are given in section 2.9.

Minimum guidelines only are given for prewash programmes; additional measures may be necessary to prepare the tank for the next cargo.

2. Pre-wash programmes for solidifying Category A, B and C substances

- Tank should be washed using the cleaning machine operated at a pressure not less than 6 bar, as soon as possible after loading cargoes. In case of category A substances washing machines should be operated in such locations that all tank surfaces are washed.
- Tank should be washed with hot water at a temperature of at least 60°C.
- The number of the washing machine cycles should not be less than that specified in Table B1. A washing machine cycle is 20 minutes at a water pressure of 6 bar.
- During washing the amount of liquid in the tank should be minimized by continuously pumping out of washing to the slop tanks or directly to reception facilities, with the ship upright and trimmed by the stern.
- If these conditions cannot be met the washing programme should be repeated three times with through stripping of the tank between washings.
- After washing the washing machines should be left operating for further 5 minutes to flush the pump and lines.

All washings must be discharged to reception facilities prior to departure from the unloading port.

3. Prewash programmes for high viscosity Category A, B, C substances

- Tanks should be washed as soon as possible after unloading with portable/fixed washing machine.
- Tank should be washed with hot water at a temperature of at least 60°C.
- During washing the amount of liquid in the tank should be minimized by continuously pumping out of washing to the slop tanks or directly to reception facilities, with the ship upright and trimmed by the stern.
- If these conditions cannot be met the washing programme should be repeated three times with through stripping of the tank between washings.
- After washing the washing machines should be left operating for further 5 minutes to flush the pump and lines.

All washings must be discharged to reception facilities prior to departure from the unloading port.

4. Prewash programmes for low viscosity or non-solidifying Category A substances within and outside special area and low viscosity or non solidifying category B substances within special areas

- Tanks should be washed as soon as possible after unloading with portable/fixed washing machine.
- The number of the washing machine cycles should not be less than that specified in Table B1. A washing machine cycle is 20 minutes at a water pressure of 6 bar.
- During washing the amount of liquid in the tank should be minimized by continuously pumping out of washing to the slop tanks or directly to reception facilities, with the ship upright and trimmed by the stern.
- If these conditions cannot be met the washing programme should be repeated three times with through stripping of the tank between washings.
- After washing the washing machines should be left operating for further 5 minutes to flush the pump and lines.

All washings must be discharged to reception facilities prior to departure from the unloading port.
5. TABLE B.1

NUMBER OF WASHING MACHINE CYCLES TO BE USED IN EACH LOCATION

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>SOLIDIFYING SUBSTANCES</th>
<th>HIGH VISCOSITY SUBSTANCES</th>
<th>NON-SOLIDIFYING OR LOW VISCOSITY SUBSTANCES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CATEGORY A</td>
<td>3 cycle</td>
<td>2 cycle</td>
<td>2 cycle</td>
</tr>
<tr>
<td>CATEGORY B</td>
<td>1 cycle</td>
<td>1/2 cycle</td>
<td>1/2 cycle</td>
</tr>
<tr>
<td>CATEGORY C</td>
<td>1 cycle</td>
<td>1/2 cycle</td>
<td>1/2 cycle</td>
</tr>
</tbody>
</table>

Note: A washing machine cycle is 20 minutes at a water pressure of 6.0 bar.
VENTILATION PROCEDURES

1. Cargo residues of substances with a vapour pressure greater than 5 kPa at 20°C may be removed from cargo tank by ventilation.

2. Before residues of noxious liquid substances are ventilated from a tank the safety hazards relating to cargo flammability and toxicity should be considered. With regards to safety aspects, the operational requirements for opening in cargo tanks in the International Bulk Chemical Code (IBC Code), the Bulk Chemical Code and the ventilation procedures in the ICS Tanker Safety Guide (Chemicals).

3. Port authorities may also have regulations on cargo tank ventilation.

4. The procedures for ventilation of cargo residues from a tank are as follows:

   4.1 The pipelines should be drained and further cleared of liquid by means of ventilation equipment;
   4.2 The list and trim should be adjusted to the minimum levels possible so that evaporation of residues in the tank is enhanced;
   4.3 Ventilation equipment producing an airjet which can reach the tank bottom shall be used
   4.4 Ventilation equipment should be placed in the tank opening closest to the tank sump or suction point.
   4.5 Ventilation shall continue until no visible remains of liquid can be observed in the tank. This shall be verified by a visual examination or an equivalent method.
121 OWNER INFORMATION

ATS Denizcilik ve Nakliyat Ticaret A.S

Balat, Karabaş Mahallesi Demirhisar Caddesi
No:47 34220 Fatih / İstanbul TÜRKİYE

Phone : +90 212 6214437 (2 lines)
Fax : +90 212 6214443
Telex : 30400 Nise Tr - 30545 Spo Tr
E-Mail : ats@atsshipping.com

General Manager: Ali Soyer
Home : 02163681694
Mobil : 05326144331

Technical Manager: Tuğrul Drin
Home: 02122360028
Mobil : 05322921878

Operation Manager: Tayfun Bozoğlu
Home: 02128638210
Mobil : 05322337597

Safety Dep: Coşkun Gündoğan
Home: 02163243493
Mobil : 05324629011

Crew Manager: Şencan Kalafat
Mobil : 05357784700

12.2 EMERGENCY NOTIFICATION

In case of emergency, the following notifications MUST be made, if the vessel has an oil spill, cargo spill, chemicals spill, substantial threat of spill, fire, explosion, grounding, collusion or any other incident which threatens the safety of the vessel, its compliment and surroundings.

<table>
<thead>
<tr>
<th>Whom to Notify / Oraganisation / Contact Nos</th>
<th>Made by</th>
</tr>
</thead>
<tbody>
<tr>
<td>Owner ( Contact nos as described above )</td>
<td>Master</td>
</tr>
<tr>
<td>Local Agents ( Contact nos as per individual case )</td>
<td>Master,Owner</td>
</tr>
<tr>
<td>State Authorities ( Contact nos as per individual case )</td>
<td>Master,Owner,Ants Chartrer</td>
</tr>
<tr>
<td>P &amp; I Club, local reps ( See Club Booklet )</td>
<td>Master, Owner</td>
</tr>
<tr>
<td>P &amp; I Club, head office</td>
<td>Master, Agents</td>
</tr>
<tr>
<td>National Authorities ( Contact : See Sope Plan )</td>
<td>Owner</td>
</tr>
</tbody>
</table>

United States

See Vessel Response Plan if applicable
12.3 MARPOL 73/78 Requirements

Protocol I
Provisions concerning reports on incidents involving harmful substances
(In accordance with Article 8 of the Convention)

12.3.1 Article I, Duty to report

The master of a ship involved in an accident referred to in Article III of this protocol, or other person having charge of this ship, shall report the particulars of such incident without delay and to the fullest extent possible in accordance with the provisions of this Protocol.

In the event of the ship referred to in paragraph 1 of this Article being abandoned, or in the event of a report from such being incomplete or unobtainable, the owner, charterer, manager or operator of the ship, their agents shall, to the fullest extent possible assume the obligations placed upon the Master under the provisions of this Protocol.

12.3.2 Article II, Methods of Reporting

Each report shall be made by Radio whenever possible, but in any case by the fastest channels available at the time the report is made. Reports made by radio shall be given the highest possible priority.

Reports shall be directed to the appropriate officer or agency specified in (2)(a) of Article 8 of the Convention.

12.3.3 Article III, When to make reports

The report shall be made whenever the incident involves:

a. a discharge other than as permitted under the present convention; or
b. a discharge permitted under the present Convention by virtue of the fact that;
   (i) it is for the purpose of securing the safety of a ship saving life at sea; or
   (ii) it results from the damage to the ship or its equipment; or
   c. a discharge of a harmful substance for the purpose of combating a specific pollution incident or for purposes of legitimate scientific research into pollution abatement or control; or
   d. the probability of a discharge referred to in sub paragraphs (a), (b), or (c) of this article.

12.3.4 Article IV, Contents of report

1. Each report shall contain in general:
   a. the identity of the ship
   b. the time and date of the occurrence of the incident,
   c. the geographic position of the ship when the incident occurred,
   d. the wind and sea conditions prevailing at the time of the incident; and
   e. relevant details respecting condition of the ship.

2. Each report shall contain particular
   a. a clear indication of the harmful substances involved, including, if possible, the correct technical names of such substances (trade names should not be used instead of the correct technical name)
   b. a statement or estimate of the quantities, concentrations and likely conditions of harmful substances discharged or likely to be discharged into the sea.
   c. where relevant, a description of the packaging and identifying marks; and
   d. if possible the name of the consignor, consignee or manufacturer.

3. Each report shall clearly indicate whether the harmful substance discharged, or likely to be discharged is oil a noxious liquid substance, a noxious solid substance or a noxious gaseous substance and whether such substances was or is carried in bulk or contained in packaged form, freight containers, portable tanks, or road and rail tank wagons.

4. Each report shall be supplemented as necessary by any other relevant information requested by the receipt of the report or which person sending the report deems appropriate.

12.3.5 Article V, Supplementary report
Any person who is obliged under the provisions of this protocol to send a report shall, when possible:

a. supplement the initial report, as necessary, with information concerning further developments and
b. comply as full as possible with requests from affected States for additional information concerning the incident.

### 12.4 Whom to Notify

The master is responsible for reporting any incident involving a spill of oil or harmful substances to as described in Chapter 1.2 of this section.

### 12.5 Communication methods

Nothing in this chapter relieves the master in using sound judgement to make sure that any incident is reported as quick as possible in the prevailing situation.

**Primary communication:**
Verbal through vessels VHF or HF radios, or land-line if available while at a terminal. When making initial report, note name and rank of receiving party, and agree on format of any follow-up report (i.e. fax or telex.)

**Secondary communication**
Telex message via HF telex

**The vessel has the following communication systems in operation:**

Satcom C
HF Radio telex
HF Radio telephone
VHF marine band radios
VHF/UHF hand held radios for on board use

### 12.6. Seaworthiness calculation assistance

The vessel may obtain assistance from its classification society for damaged condition seaworthiness calculation.

The information required from the vessel is:

- **Cargo on board** By tank, grade, specific gravity
- **Bunkers on board** By tank, grade, specific gravity
- **Draft** Fwd, Mid ship, Aft, /port and stb
- **Damage** Location and extent
- **Condition of vessel** Describe
- **Any loss of cargo or bunker** Describe
- **Action already taken** Describe
- **Action planned/suggested** Describe
- **Local conditions** Tide, wind, sea, swell, current, temperatures, nature of seabed (if grounded or in danger of grounding) forecast
- **Other significant** Describe

### APPENDIX 5

**BANNED LAST CARGOES:**
The introduction of lists of toxic substances which cannot be carried prior to vegoil cargoes will have a substantial impact on chemship trades.

1. The international Group of Protection & Indemnity (P&I) Clubs is facing millions of dollars worth of claims over contaminated animal and vegetable oil and fat cargoes which have been spoilt through contact with the remnants of highly toxic products that were born on previous voyages by the concerned vessels. Information is now being made available on unacceptable types of cargoes as submitted to the US Food and drug Administration (FDA) in Washington, DC to deal with this problem.

2. The International Group represents 15 major P&I Clubs dealing with shipowners’ third party liabilities throughout the world. The Gard Club points out that the problem affects not only shipowners and their mutual insurance associations, the P&I Clubs, but importers and national health authorities because of the dangerous effects on human life of previous chemical cargoes like benzene, ethyl acetate, etc.

3. The National Institute of Products (NIOP) in the US and Federation of Oil Seeds and Fats Association (FOSFA) in the UK are trying to eliminate such hazards and have prepared lists of cargoes which can and cannot be carried prior to the transport of vegetable oil and related cargoes for submission to the FDA and equivalent health agencies in Europe. The substances appearing in the lists prepared by NIOP are grouped into either of four categories:

a. **Acceptable prior cargoes (List No. 1):** Acceptable prior cargoes for edible oils which may or may not undergo further processing.

b. **Acceptable prior cargoes (List No. 2):** Acceptable prior cargoes for edible oils which will undergo further processing.

c. **Unacceptable prior cargo list,**

d. **Research list,**

These are shown attached.

4. The FDA introduced the NIOP list July 1, 1989. This means that a district district office of FDA finds finds that the cargo carried prior to a vegoil cargo in a ship’s tank was some chemical appearing in the “Unacceptable prior cargo list”, then such a cargo may be detained upon its entry into the USA. Detention may even be possible if that chemical appears in the “Research List”. FOSFA has also prepared a list of unacceptable substances which mirrors the similar NIOP list and which became effective in European ports at the same time.

5. In the meantime, however, the International Group believes it is essential to avoid “Unacceptable prior cargo list” as set out below, in order not to prejudice P&I cover. The Group has also strongly recommended that charterers’ acceptance of prior cargo is obtained during charter negotiations.

### NIOP LISTS OF CARGOES WHICH CAN BE CARRIED PRIOR TO THE TRANSPORT OF VEGETABLE OIL AND RELATED CARGOES

#### Acceptable prior cargoes (List No. 1):

**Cargoes:**

| Almond oil | Apple juice concentrate | Apricot kernel oil |
| Babassu oils | Candelilla wax (motan) | Canola oils |
| Carnauba wax | Castor oil | Cocoa butter |
| Cohune oil | Corn oils (maize) | Corn syrup |
| Cottonseed oils (Low erucic acid rapeseed (Glucose) oil - LEAR) | Grape juice concentrate | Grapeseed oil |
| (Glucose syrup) | Illepe butter (nowrah butter) | Lard |
| Hazelnut oil | Menhaden oil | Molessas |
| Hycopersicum esculentum oil | Nutmeg butter | Olive oil |
| Murumuru fat | Palm kernel oil oleins | Palm kernel oil oleins |
| Orange juice slurry | Palm oils | Palm oil mid fractions |
| Palm kernel oil stearines | Palm oil stearines | Peanut oils (groundnut) |
| Palm oil oleins | Rapeseed oil | Rapeseed oils (hydrogenated) |
| Poppy seed oil | | |

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Rice bran oil   Safflower oils   Sal fat
Sesame oil   Shea oil   Soybean oil
Sunflower oils   Tallow   Teaseed oil
Tucum oil   Walnut oil

NIOP LISTS OF CARGOES WHICH CAN BE CARRIED PRIOR TO THE TRANSPORT OF VEGETABLE OIL AND RELATED CARGOES

Acceptable prior cargoes (List No. 2):

Acceptable prior cargoes for edible oils which will undergo further processing:

Acetic acid   Acetone   Ammonium hydroxide
Butyric fatty acid (C-4)
Butyl Acetate   Butyl Alcohol (Butanol)
Caproic fatty acid (C-6)
Cyclohexane   Cyclohexanone
Dipentene   Ethyl Alcohol (Ethanol)
2-Ethyl hexyl alcohol   2-Ethyl hexyl alcohol
Heptane   Heptanoic acid
Isobutyl acetate   1-Isomer not containing any of the 2-
Isopropyl alcohol   Isononylic acid
Linolenic acid   Methyl alcohol (Methanol)
Methyl isobutyl ketone   Nitric acid
Phosphoric acid   Propyl acetate
Polypropylene glycol   Propylene glycol
Sulphuric acid   Soybean oil (epoxidized)

** Clearance as a prior cargo would carry the stipulation that it be specific to the 1-Isomer not containing any of the 2-
Isomers, nor would clearance be given to materials generally labelled “nitropropane” without specifying the isomer.

NIOP LISTS OF CARGOES WHICH CANNOT BE CARRIED PRIOR TO THE TRANSPORT OF VEGETABLE OIL AND RELATED CARGOES

Unacceptable prior cargo list:

These substances have been proven to be highly toxic and/ or carcinogenic. They may not be carried as the last cargo immediately prior to edible oils.

Acrylonitrile   Benzene   1,3-Butadiene
Carbon tetrachloride   Chloroform   Epichlorohydrin
Ethyl acrylate   Ethylene dibromide   Ethylene dichloride
Ethylene oxide   Formaldehyde   Leaded petroleum or
Methylene chloride   Methylenediisocyanate   other leaded products
Perchloroethylene   (MDI)   2-Nitropropane (and
Telone II (1-propene, mixtures)
, 1,3-dichloro)
Trichloroethylene   Poly methylene isocyanate (PAPI)

NIOP LISTS OF CARGOES WHICH CAN AND CANNOT BE CARRIED PRIOR TO THE TRANSPORT OF VEGETABLE OIL AND RELATED CARGOES

Research list:

For the following substances there is insufficient information available regarding identity, carcinogenicity, toxicity, removability or analyzability. They are unacceptable as the last previous cargo before the carriage of an edible oil.

Substances on this list are candidates for the acceptable list upon documented verification of their acceptability.
| Alcohol C-12 | Alcohol C-14 | Blended fertiliser |
| Butanediol | Butyl acrylate | Butyl benzyl phthalate |
| Cumene | Cyanohydrin | Detergent, dispersant in refined base oil |
| Dicyclopentadiene | Diesel oil | Diethanolamine |
| Diethylene amide | Diethylene glycol | Diethylene glycol mono ethyl ether |
| Diglycidyl ether of biphenol A(DER 331) | Dioctyl phthalate | Dodecyl benzene |
| Ethoxylated alcohols | Ethyl acrylate | Ethyl amine |
| Ethyl benzene | Ethyl ether | Ethylene glycol |
| Ethylene glycol mono butyl ether | Ethylene oxide | Ethylhexyl alcohol |
| Fuel oil 3-4-5-6 | Gasoil | Heptene |
| Isoparaffinic petroleum solvent (Isopar 4) | Jet fuel | Kerosene |
| Lub additives | Lube oils | Methyl acrylate |
| Methyl ethyl glycol | Methyl methacrylate | Methyl tertiary butyl ether (MTBE) |
| Methyl xylene | Mineral seal oil | Naphta |
| Naphthalene | Natural latex | Nonene |
| Olefins | Orange terpenes | Polypropylene, polyethylene glycols (Voranol, Niax, Polyol) |
| Polybutene | Propylene glycol mono ethyl ether | Propylene tetramer |
| Special diesel oils | Styrene monomer | Sunthene lube |
| Tall oil crude | Toluene | Triethyl amine |
| Unleaded gasoline | Vinyl acetate monomer | White mineral oil |
| Xylene, (m) | Xylene, ortho | Xylene, para |
APPENDIX 1

CAPACITY PLAN
APPENDIX 2

CARGO PIPING

DIAGRAM
APPENDIX 3

STEAM SYSTEM
APPENDIX 4

BALLAST

ARRANGEMENT
APPENDIX 5

BANNED LAST CARGOES
APPENDIX 6

PLAN OF EMERGENCY STOP BUTTONS
APPENDIX 7
CARGO COMPATIBILITY