WALLEM SHIPMANAGEMENT LTD

Safety Management System

Chemical Tanker Operations Manual
TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>REVISION SHEET</td>
<td>1</td>
</tr>
<tr>
<td>MANAGEMENT REVIEW</td>
<td>1</td>
</tr>
<tr>
<td>1.0 GENERAL</td>
<td>1</td>
</tr>
<tr>
<td>1.1 APPLICATION</td>
<td>1</td>
</tr>
<tr>
<td>1.2 COMPLIANCE WITH LAWS AND REGULATIONS</td>
<td>1</td>
</tr>
<tr>
<td>1.3 EFFECT OF THIS MANUAL AND AUTHORITY OF THE MASTER</td>
<td>1</td>
</tr>
<tr>
<td>1.4 REFERENCE PUBLICATION</td>
<td>1</td>
</tr>
<tr>
<td>2.0 CARGO HANDLING</td>
<td>1</td>
</tr>
<tr>
<td>2.1 RESPONSIBILITY</td>
<td>1</td>
</tr>
<tr>
<td>2.1.1 RESPONSIBILITY OF THE MASTER</td>
<td>1</td>
</tr>
<tr>
<td>2.1.2 RESPONSIBILITY OF THE CHIEF OFFICER</td>
<td>1</td>
</tr>
<tr>
<td>2.1.3 RESPONSIBILITY OF THE DUTY OFFICER</td>
<td>2</td>
</tr>
<tr>
<td>2.2 CATEGORIZATION OF CHEMICAL CARGO</td>
<td>3</td>
</tr>
<tr>
<td>2.2.1 CORROSIVE LIQUIDS</td>
<td>3</td>
</tr>
<tr>
<td>2.2.2 FLAMMABLE LIQUIDS – SPECIAL NOTES FOR METHANOL</td>
<td>6</td>
</tr>
<tr>
<td>2.2.3 TOXIC CARGOES</td>
<td>10</td>
</tr>
<tr>
<td>2.2.4 REACTIVE/SENSITIVE CARGOES</td>
<td>14</td>
</tr>
<tr>
<td>2.2.5 ANIMAL, FISH AND VEGETABLE OILS AND FATS</td>
<td>17</td>
</tr>
<tr>
<td>2.2.6 HIGH MELTING POINT CARGOES/HIGH VISCOSITY CARGOES/SOLIDIFYING CARGOES</td>
<td>18</td>
</tr>
<tr>
<td>2.2.7 HIGH DENSITY CARGOES</td>
<td>23</td>
</tr>
<tr>
<td>2.2.8 CARGOES GENERATING AN ELECTROSTATIC CHARGE</td>
<td>24</td>
</tr>
<tr>
<td>2.3 CARGO HANDLING OPERATION</td>
<td>29</td>
</tr>
<tr>
<td>2.3.1 GUIDELINES ON CARGO PLANNING</td>
<td>29</td>
</tr>
<tr>
<td>2.3.2 LOADING OPERATION</td>
<td>32</td>
</tr>
<tr>
<td>2.3.3 DISCHARGING OPERATION</td>
<td>40</td>
</tr>
<tr>
<td>2.3.4 SHIP TO SHIP TRANSFER OPERATION</td>
<td>45</td>
</tr>
<tr>
<td>2.3.5 SHIP TO BARGE TRANSFER OPERATION</td>
<td>45</td>
</tr>
<tr>
<td>2.4 GENERAL PRECAUTIONS ON CARGO HANDLING OPERATION</td>
<td>46</td>
</tr>
<tr>
<td>2.4.1 PREPARATIONS BEFORE CARGO HANDLING</td>
<td>46</td>
</tr>
<tr>
<td>2.4.2 SAFETY MEASURES DURING CARGO HANDLING OPERATION</td>
<td>47</td>
</tr>
<tr>
<td>2.5 PRECAUTIONS FOR CARGO CONTROL</td>
<td>51</td>
</tr>
<tr>
<td>2.5.1 PRESERVATION OF THE QUALITY OF CARGOES</td>
<td>51</td>
</tr>
<tr>
<td>2.5.2 CARGO HEATING</td>
<td>51</td>
</tr>
<tr>
<td>2.5.3 MEASURES TO PREVENT VAPOUR LOSS</td>
<td>51</td>
</tr>
<tr>
<td>2.5.4 SAFETY MEASURES AGAINST CARGO LEAKS</td>
<td>52</td>
</tr>
<tr>
<td>2.5.5 SAFETY MEASURES WITH CARGO OF METHANOL</td>
<td>53</td>
</tr>
</tbody>
</table>
3.0 INSPECTION AND MAINTENANCE OF CARGO HANDLING EQUIPMENT AT SEA 1
3.1 CARGO REMOTE CONTROL SYSTEM ......................................................... 1
3.2 MAINTENANCE OF CARGO VALVES ............................................................ 1
3.3 MAINTENANCE OF CARGO PIPE LINES ...................................................... 1
3.4 CARGO TANK BULKHEADS ........................................................................ 2
3.5 CARGO PUMPS ........................................................................................... 2
3.6 CARGO VENT SYSTEM ............................................................................... 2
3.7 CARGO HEATING PIPE LINES .................................................................... 3
3.8 LIGHTING SYSTEM AND ELECTRIC SYSTEM FOR UPPER DECK AND PUMP ROOM .................................................................................................................. 3
3.9 CARGO SAMPLES STORAGE & DISPOSAL ................................................. 3

4.0 HANDLING OF WATER BALLAST ..................................................................... 1
4.1 RESPONSIBILITY AND SUPERVISION ....................................................... 1
4.1.1 RESPONSIBILITY OF THE MASTER .......................................................... 1
4.1.2 RESPONSIBILITY OF THE CHIEF OFFICER ............................................ 1
4.1.3 TAKING ON WATER BALLAST ............................................................... 1
4.1.4 SELECTION OF TANKS TO FILL WITH WATER BALLAST ..................... 1
4.1.5 PRECAUTIONS FOR BALLASTING ......................................................... 1
4.2.1 RESTRICTIONS ON DE-BALLASTING ..................................................... 3
4.2.2 DEBALLASTING WHEN SPECIAL REGULATIONS OF THE TERMINAL OF THE PORT OF CALL ARE IN FORCE .......................................................... 4
4.3 INSPECTION AND MAINTENANCE OF EQUIPMENT RELATED TO BALLASTING/DE-BALLASTING .................................................................................. 4
4.3.1 INSPECTION AND MAINTENANCE .......................................................... 4
4.3.2 ACTION WHEN THE OIL DISCHARGE MONITORING AND CONTROL SYSTEM IS OUT OF ORDER ............................................................................. 5

5.0 TANK CLEANING AND GAS-FREEING OPERATION ........................................... 1
5.1 GENERAL .................................................................................................... 1
5.1.1 REQUIREMENTS FOR CARRYING OUT TANK CLEANING OPERATION........................... 1
5.1.2 REQUIREMENTS FOR PROHIBITING TANK CLEANING .............................. 1
5.1.3 SUSPENSION OF TANK CLEANING OPERATION ........................................ 2
5.2 RESPONSIBILITY AND SUPERVISION ...................................................... 3
5.2.1 RESPONSIBILITY OF THE MASTER .......................................................... 3
5.2.2 RESPONSIBILITY OF THE CHIEF OFFICER ............................................ 3
5.2.3 RESPONSIBILITY OF THE DUTY OFFICER ............................................. 3
5.3 PROCEDURE FOR TANK CLEANING OPERATION ....................................... 4
5.3.1 TANK CLEANING METHODS .................................................................. 4
5.3.2 PREPARATION FOR TANK CLEANING .................................................. 6
5.3.3 TANK CLEANING OPERATION ............................................................... 7
5.3.4 TANK WASHING ATMOSPHERES ......................................................... 9
5.3.5 CLEANING METHODS FOR EACH TYPE OF CARGOES ......................... 13
5.4 GAS-FREEING OPERATION ....................................................................... 15
### Table of Contents:

5.4.1 EXECUTION OF GAS-FREEING OPERATION ............................................ 15
5.4.2 PROCEDURES AND PRECAUTIONS FOR GAS-FREEING OPERATION .. 18
5.4.3 ELECTRICAL STORMS................................................................. 21
5.4.4 EFFECT OF WIND.............................................................................. 21
5.5 GAS TESTING..................................................................................... 21
5.5.1 PRECAUTIONS FOR GAS TESTING.................................................. 21
5.5.2 HANDLING GAS TESTING DEVICES ................................................. 22
5.6 ENTRY INTO CARGO TANKS AND OTHER ENCLOSED SPACES ............ 23
5.6.1 ENTRY INTO ENCLOSED SPACES BEING NOT ENSURED ...................... 23
5.6.2 WORK IN ENCLOSED SPACE.......................................................... 23
5.7 TANK CLEANING AND GAS-FREEING OPERATIONS FOR DRYDOCKING25
5.7.1 OBJECTIVES OF THE OPERATIONS .................................................. 25
5.7.2 OPERATION PLAN.............................................................................. 25
5.8 VISUAL INSPECTIONS ....................................................................... 25
5.9 WALL WASH TEST PROCEDURES...................................................... 25
5.10 DISPOSAL OF TANK WASHINGS, SLOPS & DIRTY BALLAST ............... 28
5.10.1 MANDATORY PRE-WASH WATER ..................................................... 28
5.10.2 DIRTY BALLAST........................................................................... 28
5.10.3 SAFETY PRECAUTIONS DURING DISCHARGE OF CARGO SLOPS INTO THE SEA....................................................................................................... 28
5.10.4 MANAGEMENT OF SLOP TANKS ..................................................... 28

6.0 NITROGEN PURGING / PADDING & INERT GAS SYSTEM ......................... 1
6.1 REASONS FOR PURGING / PADDING ................................................... 1
6.2 GUIDANCE FOR VESSEL RECEIVING GASEOUS NITROGEN FROM SHORE ........................................................................................................... 1
6.3 QUANTITY OF NITROGEN REQUIRED.................................................... 3
6.4 DRYING OR PURGING AN EMPTY TANK THAT HAS BEEN CLEANED AND GAS FREED.............................................................................................. 3
6.5 PADDING OF LOADED TANKS (AS GUIDELINE ONLY)............................. 5
6.6 INERT GAS SYSTEM ............................................................................ 7
6.6.1 GENERAL....................................................................................... 7
6.6.2 RESPONSIBILITY............................................................................. 8
6.6.3 SYSTEM MANUAL.......................................................................... 8
6.6.4 INERTING BEFORE LOADING ......................................................... 8
6.6.5 LOADING ....................................................................................... 8
6.6.6 ON PASSAGE ................................................................................ 9
6.6.7 DISCHARGE .................................................................................. 9
6.6.8 TANK CLEANING.......................................................................... 9
6.6.9 GAS FREEING................................................................................ 9
6.6.10 INERT GAS SAFETY CONTROLS ................................................... 9
6.6.11 SAFETY CHECKS WHEN PLANT IS SHUT DOWN ......................... 10
6.6.12 SYSTEM TEST SCHEDULE............................................................. 10
6.6.13 MAINTENANCE PROGRAM.............................................................. 10
6.6.14. EXCHANGE OF TANK ATMOSPHERE ................................................................. 11
6.6.15 COMPOSITION AND QUALITY OF INERT GAS ........................................... 11
6.6.16 INERT GAS SYSTEM FAILURE ................................................................. 11
6.6.17 ACTION TO BE TAKEN ON FAILURE OF THE INERT GAS SYSTEM ....... 12

7.0 SAFETY ONBOARD ........................................................................................... 1
7.1 GENERAL ..................................................................................................... 1
7.2 PROTECTIVE CLOTHING .............................................................................. 1
7.3 MATERIAL SAFETY DATA SHEETS (MSDS) ................................................ 1
7.4 EXPOSURE TO CHEMICAL ........................................................................... 2
7.5 VAPOUR INHALATION ................................................................................... 2
7.6 SKIN CONTACT ............................................................................................ 4
7.7 FILTER MASK ............................................................................................... 4
7.8 NITROGEN HAZARD ..................................................................................... 5
7.9 MEDICAL EMERGENCIES ............................................................................ 6

8.0 EMERGENCY PROCEDURES .......................................................................... 1
8.1 LOSS OF STABILITY ...................................................................................... 1
8.2 OVERSTRESSING DUE TO HIGH DENSITY CARGOES .............................. 2
8.3 OVERFILLING OF CARGO TANK ............................................................ 3
8.4 POLYMERISATION – SOLIDIFICATION OF CARGO ..................................... 5
8.5 BRITTLE FRACTURE ..................................................................................... 6
8.6 TANK OVER-PRESSURE ............................................................................... 7
8.7 ROLLOVER .................................................................................................... 8
8.8 THERMAL STRESS ........................................................................................ 9
8.9 EMERGENCY DISCHARGE DUE LOSS OF PUMPABILITY ........................ 10

APPENDICES ........................................................................................................ 1
APPENDIX 1: CARGO TRANSFER PROCEDURE ..................................................... 1
APP 1.1 OIL TRANSFER OPERATIONS AS PER US 33CFR 155.750 (A) (3)/(4)/(5) .......................................................... 1
APP 1.2 GENERAL ............................................................................................. 1
APP 1.3 RESPONSIBILITY OF THE MASTER .................................................... 1
APP 1.4 RESPONSIBILITIES OF THE CHIEF OFFICER .................................. 1
APP 1.5 RESPONSIBILITY OF THE CHIEF ENGINEER .................................... 2
APP 1.6 DELEGATION OF DUTIES & RESPONSIBILITIES ............................... 3
APP 1.7 OIL TRANSFER PROCEDURE 33 CFR 155.750 ................................ 3
APP 1.8 DESCRIPTION OF THE CARGO SYSTEM, OPERATIONAL AND EQUIPMENT PARAMETERS US CFR 33 155.750 (2) (I) (II) ........................................ 5
APP 1.9 CAPACITY AND METHODS OF DRAINAGE OF DRIP TRAYS .......... 8
APP 1.10 BALLAST SYSTEM .............................................................................. 9
APP 1.11 COMPLETE SHIP/SHORE CHECK LIST AND OTHER RELEVANT CHECKLISTS PRIOR COMMENCEMENT OF CARGO OPERATION .... 10
APP 1.12 BALLASTING CARGO TANKS ............................................................ 11
APP 1.13 DISCHARGE OF DIRTY BALLAST .................................................... 11
APP 1.14 DISCHARGING DIRTY BALLAST ............................................................ 12
APP 1.15 DECANTING SLOP TANKS ................................................................. 13

APPENDIX 2 – SHIP SPECIFIC CHECKLISTS ......................................................... 1
CHECKLIST NO. 1 – PRIOR DISCHARGE ............................................................ 1
CHECKLIST NO. 2 - PRIOR LOADING ................................................................. 1
CHECKLIST NO. 3 - DEPARTURE PORT .............................................................. 1
CHECKLIST NO. 4 - HELICOPTER OPERATIONS ................................................ 1
CHECKLIST NO. 5 - WEATHER MONITORING & HEAVY WX IN PORT ............. 1
CHECKLIST NO. 6 - COLD-WEATHER CHECKLIST ............................................ 1
(PRIOR ENTERING WINTER ZONE ) ................................................................. 1
CHECKLIST NO. 7 - CONTINGENCY PLANNING FOR STS OPERATIONS ......... 1
CHECK LIST NO. 8 – DURING LOADING / DISCHARGING OPERATION ......... 1
(HAZARDOUS CARGO) ..................................................................................... 1

APPENDIX 3 (A) - BUNKER TRANSFER PROCEDURES ........................................ 1
1.0 BUNKERING TRANSFER PROCEDURES .................................................... 1
1.1 PERSONNEL AND THEIR DUTIES ............................................................ 1
1.1.1. OVERALL IN CHARGE - CHIEF ENGINEER ......................................... 1
1.1.2. ASSISTANT TO CHIEF ENGINEER - BUNKER OFFICER ..................... 1
(3RD OR 4TH ENG. AS NOMINATED BY C/E) .............................................. 1
1.1.3. ASSISTANT TO BUNKERING OFFICER (TWO ER RATINGS) .............. 2
1.1.4. SPARE MEN - AS DESIGNATED BY CHIEF ENGINEER ....................... 2
1.1.5. DECK DEPARTMENT - PERSONNEL SHOULD ENGAGE IN THE FOLLOWING ITEMS OF WORK TO ASSIST IN THE BUNKERING OPERATION. ................................................................. 2
1.2. INFORMATION ........................................................................................... 3
1.3. PRECAUTIONS .......................................................................................... 4
1.4. POLLUTION CONTROL ........................................................................... 5
1.5. QUALITY AND QUANTITY CONTROL .................................................... 5
1.6 DURING THE VOYAGE .............................................................................. 7
1.7 BUNKER ANALYSIS REPORT ................................................................... 7
BUNKERING SAFETY CHECKLIST ..................................................................... 1
1. BUNKERS TO BE TRANSFERRED ................................................................. 1
2. BUNKER TANKS TO BE LOADED ................................................................. 1
3. CHECKS BY BARGE PRIOR TO BERTHING ............................................. 1
4. CHECKS PRIOR TO TRANSFER .................................................................. 3
DECLARATION ................................................................................................... 4

APPENDIX 3(B) - BUNKER PROCEDURES CHECKLISTS ....................................... 1

APPENDIX 4 (A) - ENGINE ROOM PROCEDURES ............................................. 1
1. GENERAL .................................................................................................... 1
2. CHIEF ENGINEER’S STANDING ORDERS ................................................ 2
3. CONTROL OF HAZARDOUS MATERIAL USED ON BOARD ........................ 5
4. ENGINE ROOM EMERGENCY PROCEDURES ............................................. 9
4.1 SHIP SPECIFIC PROCEDURES ................................................................. 9
4.2 MEASURES IN CASE OF FIRE IN ENGINE ROOM ..................................... 9
4.3 MEASURES IN CASE OF GROUNDING (SPECIFIC TO ENGINE ROOM) 11

APPENDIX 4 (B) - ENGINE ROOM CHECKLIST ................................................. 1
E/R CHECKLISTS NO. 1 - STEERING GEAR TEST ............................................. 1
E/R CHECKLISTS NO. 2 - ARRIVAL PORT ....................................................... 1
E/R CHECKLISTS NO. 3 - DEPARTURE PORT ................................................. 1
E/R CHECKLISTS NO. 4 - SHIFTING ............................................................... 1
E/R CHECKLISTS NO. 5 - UMS OPERATION .................................................... 1
E/R CHECKLISTS NO. 6 - AUXILIARY ENGINE START/STOP ......................... 1

APPENDIX 5 : EMERGENCIES SPECIFIC TO CHEMICAL TANKER ...................... 1
CHECKLIST NO. 1 : LEAK OF CARGO INTO DOUBLE HULL SPACES, COFFERDAMS ................................................................. 1
CHECKLIST NO. 2 : TOXIC LIQUID RELEASE AT THE TERMINAL ..................... 1
CHECKLIST NO. 3 : TOXIC LIQUID RELEASE AT SEA .................................... 1
CHECKLIST NO. 4 : BREAKAWAY FROM JETTY DURING CARGO TRANSFER .. 1

(!) APPENDIX 6 - WALLEM MARPOL COMPLIANCE PROGRAM (WMCP) .............. 1

(!) APPENDIX 7 - SAFETY OFFICER INSPECTION CHECKLIST ............................. 1

(!) APPENDIX 8 - PRIVATE MARITIME SECURITY COMPANY (PMSC ) PROCEDURES ...... 1
## REVISION SHEET

<table>
<thead>
<tr>
<th>NO.</th>
<th>DATE</th>
<th>REVISED PAGE(S)</th>
</tr>
</thead>
<tbody>
<tr>
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<tr>
<td></td>
<td></td>
<td><strong>Table of Contents: Pg. 1/6 &amp; 6/6 Revision Sheet : 1/1</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Management Review : 1/1</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Appendices Index : Pg. 3</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Appendix 6 : Pg. 1</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Master Self Audit Checklist: 1/1</strong></td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Appendix 8 : Pg. 5</strong></td>
</tr>
<tr>
<td></td>
<td>Jun 2016</td>
<td></td>
</tr>
</tbody>
</table>
This is a quality review of the system and/or procedures on a yearly basis to consider the need for system improvement. When these reviews are done, comments from the Masters’ review will also be taken into account.
1.0 General

1.1 Application

This Manual is applicable to all chemical tankers under the management of the Company.

1.2 Compliance with laws and regulations

The Master must familiarize himself and comply with statutory laws and regulations, various rules of the Company and the terminal regulations of ports of call. It is Master's responsibility to ensure that prevalent rules and regulations are thoroughly understood and implemented in regards to the stowage, segregation, compatibility, safety precautions, any special requirements for the type of cargo to be loaded. All tank cleaning procedures including prewash requirements, ventilation requirements, discharge of the tank washings must be clearly made clear to all involved in the stowage, carriage tank cleaning and all other cargo operations including gas freeing and preparing VSL for dry docking or other repairs.

1.3 Effect of this manual and authority of the Master

This Manual does not restrict instructions given or actions taken by the Master as considered necessary for the protection of human life, securing safety of the vessel, preservation of cargo and prevention of pollution. It does not restrain the Master's authority to give such instructions or to take actions even if they are not in conformity with procedures and instructions specified.

1.4 Reference Publications

Following reference publications provide useful guidance and international regulations for carrying hazardous chemicals at sea.

1) SOLAS (latest consolidated version)
2) MARPOL 73/78 (latest consolidated version)
3) International Safety Guide for Oil Tankers and Manuals (ISGOTT)
4) ICS Tanker Safety Guide (Chemical)
5) Procedure and Arrangements Manual (Approved by Class)
6) Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk
7) Certificate of Class (re tank strength for high density cargoes)
8) Ship’s “VEC System Operating Manual” (Approved by Class)
9) BCH/IBC Code
10) CFR 33 Parts 124 to 199
11) Guide to Port Entry
12) Ship to Ship Transfer Guide (Petroleum)
13) Safety in Oil Tankers
14) Safety in Chemical Tankers
15) IMDG Code
16) Supplement to IMDG Code (Including MFAG and Ems)
17) SMPEP
18) Clean Seas Guide for Oil Tankers
19) FOSFA (for Oils, Seeds and Fats)
20) Tank Coating Manufacturer’s Compatibility Lists
21) Prevention of Oil Spillage through Cargo Pumproom Sea Valves
22) CHRIS (Chem Hazardous Response Info Systems) Guide (USCG)
23) USCG Chemical Data Guide for Bulk Shipment by Water
24) MSDS for particular cargo carried
25) Tank Cleaning Guide
2.0 Cargo handling

2.1 Responsibility

2.1.1 Responsibility of the Master

(1) The Master has the whole responsibility for cargo handling operations as specified in this Manual. He must ensure that his crew members are familiar with all aspects of their respective duties.

(2) In supervising cargo operations, the Master must be conversant with the contents of relevant laws and regulations, charter parties and sailing / shipping instructions, etc.

(3) Before approving a cargo handling plan prepared by the Chief Officer, the Master must check and evaluate the appropriateness of the plan in view of this Manual, statutory laws and regulations, and the regulations of the terminals concerned.

(4) During cargo handling operations; the Master must assign officers and crew to maintain a proper watch.

(5) The Master must hold a meeting before arrival at port and disseminate the cargo handling plan and safety measures among the crew members so that they may be thoroughly familiar with them.

(6) The Master must obtain all the information in the form of cargo data sheets and etc, from the shippers and must explain to all ship staff.

2.1.2 Responsibility of the Chief Officer

(1) The Chief Officer is directly responsible for cargo handling operations. He is also responsible for commanding and supervising the operations under the direction of the Master on the basis of the cargo handling plan approved by him. He must post Cargo Data Sheets in conspicuous spaces for all on board to refer to.

(2) The Chief Officer must familiarize himself with the properties of cargo and prevent the occurrence of accidents and should be thoroughly familiar with the Antidotes for the cargo carried in case of personal contact and etc.

(3) The Chief Officer must post the cargo operation plan in the cargo control room (CCR) and give necessary orders to other deck crew members in writing or verbally, thereby to accomplish the operation safely and efficiently.

(4) Before commencing cargo operations, the Chief Officer must direct other deck officers and crew to check cargo handling equipment for proper operation and maintenance, and re-adjust it, if necessary. Requirements for what type of cargo it is? Is it on the International Certificate of Fitness for the carriage of dangerous chemicals in bulk for the vessel? What type of coating requirements are suitable?
What type of Hazards are there? What safety precautions are needed? Consult chapter 17 of the IBC Code and make out the approval for cargo plan. In case the Code does not apply then chapter 18 of the IBC Code must be consulted for the cargo plan. What is the maximum quantity of chemical that each tank can be loaded should be checked and verified as per Chapter 16 of the IBC Code requirements.

In case your ship is capable of carrying special cargoes as per Chapter 15 of the IBC Code then the C/O & Master must refer to this chapter prior approving the Cargo Plan. All necessary precautions must be strictly complied with. Please note Chapter 15 cargoes are very dangerous cargoes requiring very special precautions. In cases where the Master is not satisfied with the information provided to him regarding all the properties of the cargo to be loaded and all the precautions required for the transportation, suitability for the type of coating required or any other special precautions which may be required then the Master has all the rights to ask for all the related information from the shippers/charterers and in case he does not get the information necessary then he should refuse the loading of such chemicals and inform the Owners and the Company immediately.

(5) The Chief Officer must establish a watch arrangement during cargo work and make it well known to crew members, and post it in the CCR.

2.1.3 Responsibility of the duty officer

(1) The duty officer must thoroughly understand the cargo pumps, pipe lines, and other cargo handling equipment and instruments, deck auxiliary machinery, fire-fighting and life-saving equipment as well as cargo handling operations.

(2) The duty officer or his substitute should enter the pump room at least once every hour during cargo handling operations to check the operational condition of each pump, measure the pressure and temperature of each pump at the same time, and results should be recorded accordingly. For the pump room entries, the pump room entry permit provided in the Safety Manual Section 19.1.2 has to be complied with.

(3) The duty officer must assign crew members, upon commencing cargo or ballast water handling operations, to monitor the sea surface around the vessel in order to prevent oil leaks and/or oil spills. In addition, he must check for the presence of leaks at regular intervals during cargo handling operations.

(4) The duty officer must not fail to take due care by constantly directing and supervising deck ratings on watch so that cargo handling operations may progress safely and efficiently. He should also post them at specified stations in order to take action required in response to any circumstances.

(5) Should any problem beyond his judgment occur, the duty officer should inform the Chief Officer and obtain his instructions.
(6) The duty officer must make efforts to maintain proper communication with the duty engineer (or the person on unmanned duty) so that the cargo operation may be accomplished safely and efficiently.

2.2 Categorization of Chemical Cargo

Chemical cargo means the cargo described in the "IMO Certificate of Fitness for the Carriage of Dangerous Chemical in Bulk" and shall be categorized as follows.

2.2.1 Corrosive Liquids

Acids, anhydrides and alkalis are among the most commonly carried corrosive substances. They can rapidly destroy human tissue and cause irreparable damage. They can also corrode normal ship construction materials, and create a safety hazard for a ship. Acids in particular react with most metals, evolving hydrogen gas which is highly flammable. The IMO Codes address this, and care should be taken to ensure that unsuitable materials are not included in the cargo system. Personnel likely to be exposed to these products should wear suitable personal protective equipment.

Acids

In chemical terms, an acid is a substance containing hydrogen which, when dissolved in water, becomes dissociated and generated hydrogen ions. In high concentrations, many inorganic (or mineral) acids passivate mild steel rather corrode it. But if the acid is diluted with water rapid corrosion will occur.

The most corrosive concentrated acid cargoes include nitric acid, sulphuric acid, chlorosulphonic acid and chloropropionic acid. Formic acid and acetic acid are also highly corrosive in concentrations above 90%. Some acids are called fuming acids because of a characteristic appearance as they give off corrosive acid vapours, during which large quantities of acidic fumes are generated.

Acids can also have other dangers. Nitric acid is a powerful oxidizing agent. It can cause fire in contact with combustible materials; therefore materials such as sawdust and cloth should never be used to collect spilled Nitric acid or other oxidizing agents. Sulphuric acid and chlorosulphonic acid react violently with water; the reaction gives off large amounts of heat which causes the water to boil. Some acids are toxic as well as corrosive and can cause damage to body as well as the acid burn at the point of contact.

Alkalis

Alkaline substances are those which contain the oxirile group OH-. When dissolved in water, basic substances get dissociated and generated OH- ions. Alkaline solutions contain such OH- ions in higher concentration than pure water. For example Sodium Hydroxide (Caustic Soda, NaOH) is a alkaline substance; dissolved in water it gets disassociated into Na+ and OH- ions.

Common inorganic alkalis such as potassium hydroxide and sodium hydroxide (Caustic Soda) are corrosive to aluminum, zinc, galvanized steel and mercury, so those materials
must not be used for cargo containment system when carrying such chemicals. Most Alkalis have corrosiveness as either the primary risk or the secondary risk after flammability.

Acids and Alkalis react together to form salts and water, often with a violent emission of heat

**Personal Protective Equipment**

Normal footwear and fabric clothing provide no barrier against corrosives. Therefore suitable PPE must be worn when corrosive liquids are handled, with particular attention to protection of eyes.

If other methods, such as engineering controls, are not available or effective enough to control exposure to corrosives, wear suitable personal protective equipment (PPE). Choosing the right PPE to wear when doing a particular job is essential. MSDSs should provide general guidance. Selecting PPE for a specific job is best done with the help of someone who knows how to evaluate the hazards of the job and how to select the proper PPE.

**Avoid Skin Contact**

Wear protective gloves, aprons, boots, hoods, or other clothing depending on how much chance there is of skin contact. This clothing must be made of materials that resist penetration or damage by the chemical. The MSDS should recommend appropriate materials. If it does not, contact the chemical's manufacturer or supplier for specific information.

**Protect Your Eyes and Face**

Always wear eye protection when working with corrosives. Although ordinary safety glasses provide some protection, chemical safety goggles are best. In some cases, you should also wear a face shield (with safety glasses or goggles) to protect your face from splashes.

**Avoid Breathing Corrosive Vapours, Fumes, Dusts or Mists**

Use compressed air breathing apparatus for protection against corrosive vapours, fumes, dusts or mists.

**Note: Filter Masks are prohibited for use on all Wallem managed vessels.**

**Know and be familiar with the right PPE for emergencies, as well as normal operations. You must wear the PPE needed for doing a particular job. PPE cannot protect you if it is not worn.**

**MSDS**

The MSDS for a particular corrosive should give specific first aid instructions in case of exposure by skin or eye contact, inhalation, or swallowing.
Most injuries caused by common corrosives, such as acids and bases, result from accidental skin or eye contact. The first aid for these injuries usually involves flooding the contaminated area with large amounts of water. However, the specific first aid recommendations can vary from one corrosive material to another, depending on the nature (properties and hazards) of the material.

Emergency eyewash stations and safety showers should be present wherever accidental exposure to corrosives might occur.

Only specially trained people, equipped with the proper tools and protective equipment, should handle the emergency. Nobody else should go near the area until it is declared safe.

Planning, training and practicing for emergencies are important so that everyone knows what they must do.

The MSDS for the cargo is a good starting point for drawing up an emergency plan. MSDSs have specific sections on fire and explosion hazards, including suitable fire extinguishing equipment and methods, spill clean-up procedures and first aid instructions.

(1) Characteristics of Corrosive Liquids

Corrosive liquids have generally the following characters.

a. Corrosively
   They generally corrode normal construction materials at extensive rate and need special materials for the cargo tanks and handling systems to ensure safe containment.

b. Fire
   When they corrode some metals or contact with fibrous materials, generation of flammable gas or ignition of fibrous materials may occur.

c. Effect to human body
   They destroy human skin causing serious damage which may be permanent.

(2) Precautions for handling corrosive liquids

a. Materials of tank and cargo handling equipment shall be of corrosion resistant and in conformity with IBC/BCH Code.

b. Obtain and read the Material Safety Data Sheets (MSDSs) of the cargoes onboard.

c. Be aware of all of the hazards (fire/explosion, health, chemical reactivity) of the cargoes onboard.

d. Protective clothing suitable to the subject corrosive liquid shall be used. Especially, attention should be paid to spots of remaining liquid when opening tank, space, valve, pipe or blank.

e. Materials such as cotton shall not be used in sweeping corrosive liquids
f. When contacting with corrosive liquid, take off affected clothing immediately and wash away the liquid on the skin with plenty of water.
g. A cloth/Sawdust or any other flammable material shall not be used for cleaning corrosive liquids because this may cause fire.

Please also refer appendix B of Tanker Safety Guide (Chemical) for details on corrosive substances. Chapter 9 of the tanker Safety Guide (Chemicals) provides full description on the Personal Protection Equipment. Also refer section 8 of this manual on “Safety onboard”.

Reference also to be made to IMDG code supplements MFAG and EMS in case of any emergencies related to “Corrosive Cargoes”.

2.2.2 Flammable Liquids – Special Notes for Methanol

(1) Flammable liquids are liquids, or mixtures of liquids, or liquids containing solids in solution or suspension which give off flammable vapour at or below 60 degrees Celsius closed-cup test (corresponding to 65 degrees Celsius open-cup test), normally referred to as the “Flashpoint”. This also includes:

a) Liquids offered for transport at temperatures at or above their flashpoint; and
b) Substances transferred or offered for transport at elevated temperatures in a liquid state, which gives off a flammable vapour at temperatures equal to or below the maximum transport temperature.

Note: Please refer IMDG code Chapter 2.3 (Class 3 – Flammable liquids for details)

(2) Special Notes for Methanol

1) Methanol physical features
   • Methanol CH3OH, trade name methyl alcohol. UN No. 1230
   • Flammable in presence of an ignition source.
   • For small fires extinguishing medium dry chemical C02 or water
   • For large fires medium water spray. 3 or 6 % AFFF.
   • Methanol burns with a clean clear flame almost invisible in daylight.
   • Flashpoint 11 Deg. C (TCC method) 15.6 Deg. C (TOC method)
   • LEL 6% UEL 36%
   • Auto ignition temp 385 Deg C
   • Combustion produces Toxic Gases and vapours which are oxides of carbon and formaldehyde.
   • Chemically stable and miscible with water.
   • Odour is slightly alcohol like, with odour threshold 2000 ppm. Its TLV is only 200 ppm.
   • Appearance is clear colorless liquid.
   • SP> GRWY 0.792, boiling point 64.5 deg. C
   • Vapour pressure 96 mm Hg at 20 Deg C.
   • Readily soluble in water separates from oil.

2) Spill/leak response for Methanol:
• Being flammable, release can cause an immediate fire/explosion hazard.
• Eliminate all sources of ignition, i.e. no smoking, no naked lights etc.
• Stop leakage and use absorbent materials for collection.
• If necessary/possible contain spill by diking.
• Consider using AFFF foam to diminish vapour and fire hazard.
• Prevent spilled methanol from entering sea chests. Change over to lower sea suction on side opposite to spill.
• Restrict access to the spill area of any unauthorised /unprotected personnel.
• Positive pressure SCBA(breathing apparatus) sets must be worn by persons close to the spill area.
• Do not walk through spilled methanol as if it is on fire, it will not be visible in daylight.
• Wear chemical resistant clothing and protective outfits. Butyl and nitrile rubbers arc recommended.
• Fireman outfits does not necessarily provide effective protection from methanol contact. Similarly raincoats are also ineffective.
• For disposal of collected methanol absorbent material waste. contact the proper authorities or incinerate.
• Methanol wastes are not suited for underground injection.
• Methanol biodegrades easily in water.
• Methanol in fresh water or salt water may have serious effects on aquatic life.
• Methanol CH30H will get broken down to carbon dioxide and water.
• Consider using flotation booms to restrict overside spill. or using old synthetic mooring rope, or old fire hoses inflated with compressed air as a boom.
• Subject to approval for its use consider using oil spill dispersants.
• Keep an accurate account of events with chronological records.
• Change the air-condition intakes into partial recirculation mode.
• Change ships course/speed if possible to allow wind to carry spilled vapours away from the ship.
• Record all telephone and VHF conversations with other parties.

3) Practical advice for the safe carriage of methanol:
• Before arrival port remove salt from cargo deck by washing down with fresh water. This will prevent salt being picked up by the surveyor sample bottles and clothing. This is especially if the vessel has encountered heavy weather on voyage.
• Prevent rain water entering cargo tanks.
• Inspect tanks frequently on ballast voyages and in plenty of time before arrival to ensure no water leaks from ballast tanks or from other sources. Tank lid packing should be regularly checked and any worn, deformed, spilt or suspect packing must be renewed. Vent lines and other tank openings should also be inspected on a
regular basis. Should a leak be found, allow sufficient time to carry out repairs.

- Each 1000 tons of methanol expands at a rate of 1.6 cubic meters for each 1 degree centigrade rise in temperature. Approx. SG at 15 degree centigrade=.795
- After loading, drain all cargo lines into tanks so as the loading lines remain empty on the voyage. At discharge ports surveyor may try to take lines samples prior to discharge and if the line have been full throughout the voyage, these samples will most likely fail analysis.
- Always double check all cargo tank openings are tightly closed. Cargo tank vents must be maintained in very good condition and the openings covered with canvas covers if necessary. On loading some vessels load with the PV valves closed in the operating position for a few minutes. The slight overpressure in the tank enables to “hear” for any leaks from any tank hatches or other openings.
- Never allow cargo lines or cargo tanks to be opened when sea spray is in the air. Try to minimize using sea water on deck for cleaning. If you have then close all openings tight and do not aim jet of water at tank packing.
- People working in the cargo tanks must not touch the tank surfaces with their hands as human sweat contains a lot of salt. If work has been necessary in a tank, spray the tank down with de-ionised or distilled water to remove salt from perspiration. It is a good idea to use disposable shoe covers when working inside tanks.
- Do not wash or steam tanks after carrying methanol. If tanks are to be all wash tested prior to loading it is only necessary to remove remaining product traces from the tanks. Drain all lines and ventilate well. More ventilation will be required prior to arrival loading port as tank will gas up again from product trapped within the coating.
- You should not use compressed air for clearing cargo lines containing methanol because;
  - There is a high explosion hazard due to generation of static electricity.
  - Water condensation and oil in the compressed air will contaminate the methanol.
  - Only Nitrogen should be used to clear lines.
- Closing following purging routines on Deepwell cargo pumps so as to ensure there is no contact between methanol and hydraulic oil. Methanol very easily leaks into the pump cofferdam.
- Check void spaces and ballast tanks on loaded passage for methanol leakage. Because of the small molecular structure of methanol, it will leak through the smallest crack where water cannot.
- A methanol/water mixture will destroy epoxy coatings.
- All drain plugs on the cargo system should have a valve and plug. The plug can then be removed for draining the line without the
crewman being sprayed with cargo. The flow can then be controlled by the valve.

4) Discharge of methanol into sea:
AS per MARPOL Annex II Regulations, methanol being a category ‘Y’ substance, its discharge is permitted into sea. under following conditions:

- Strip the cargo tank efficiently with adequate trim and list as required.
- Residue in the tank should not exceed 150 liters for Existing IBC constructed from 31/7/1986 but before 1/1/2007 and residue in the tank not to exceed 75 liters for New Buildings constructed from 1/1/2007
- However line content is larger. Therefore use stripping pump and strip all Top Lines, bottom lines etc to shore using the manifold cross over provided on off shore side.
- Ventilating the tank will vaporize all remaining liquid methanol in tank.
- Any water subsequently introduced into the tank may be discharged into the sea without any restrictions.
- However if required to discharge undiluted residues into sea, then the following to be complied with:
- The tank to be stripped to 150 ltrs for existing ships and 75 litres for New Ships (Constructed after 1/1/2007)
- The ship is proceeding en route at a speed of not less than 7 knots
- The discharge is made **below the waterline** through the underwater discharge outlet and not exceeding the maximum rate for which the underwater discharge outlet is designed
- The discharge is made at a distance not less than 12 nautical miles from the nearest land in a depth of water of not less than 25 meters.

c) Emergency jettisoning of methanol into sea:
- Jettisoning of cargo of methanol is an extreme emergency measure to be adopted by master in order to save life or save ship.
- Jettisoning of cargo is to be considered as an option when the remainder of the cargo can be saved and thus greater pollution of the environment can be prevented.
- Master must inform the managers, owners, charterers, agents etc, accordingly.
- In accordance with SMPEP, master must report to the coastal state stating or estimating the quantities and concentration of the liquid methanol likely to be jettisoned into the sea.
- Master should also explain the probable consequences of failure to jettison.
- All parties should then be closely informed of the status/situation as it unfolds.
- Full details should be entered into the deck log book and if required in the official log book.
• Sea chest intakes should be changed as necessary and all other safety precautions to be taken as for an oil spill as given in item 2) and 4) above.(sec.2.2.2)
• Carry out actual jettisoning using flexible hose at manifold and flexible hose to be long enough to reach under the water line.
• Or carry out actual jettisoning using lower overboard discharge pipeline in pump room after making manual override/bypassing the ODME.

Note: “Manual Spraying of Methanol in cargo tanks is prohibited”

2.2.3 Toxic Cargoes

A toxic substance is one which is liable to cause either harm to human health, serious injury or death. Toxic means the same as poisonous. Toxicity is an intrinsic property of a chemical, which man cannot modify, and its effect is a function of exposure. In some cases, correct response to its effects after exposure can diminish its consequences.

There are three common ways that a cargo can be toxic: swallowed (oral toxicity), absorbed through the skin, eyes and mucous membranes (dermal toxicity) or inhalation as a vapour or mist (inhalation toxicity).

A chemical may be toxic by more than one of these routes: for example, toxic vapours and mists affect people most via the respiratory system but they can also be absorbed through the skin. The smaller the quantity (or dose) of the substance that is required to harm health, the more toxic a substance is. In some cases the toxic effect of a chemical can be countered by administering antidotes, but in most cases the hazard must be avoided by correct use of protective clothing, breathing apparatus and ventilation procedures. If there is no exposure to the chemical, or if exposure is reduced to safe levels, there can be no toxic effect.

In tanker operations, contact with a liquid or inhalation of a vapour are the most likely forms of exposure. In general, proper procedures and proper use of personal protective equipment will prevent exposure and thus the effects of toxicity.

Toxic effects

Toxicity can be acute, sub-acute and chronic. A substance has acute toxicity if a single exposure is sufficient to cause harm almost immediately. Substances commonly called poisons have extreme acute toxicity.

A substance with sub-acute toxicity displays its effects after a person has had repeated exposures to doses too small to cause an acute effect. Examples are allergic sensitisers, which induce reactions to other substances.

A substance has chronic toxicity if its effects appear after a period of continuous exposure to doses too low to cause any acute effect. Examples are carcinogens (cancer inducing), teratogens and mutagens (which affect reproduction).

Threshold limit value (TLV)
A threshold limit value for a given substance is the maximum concentration of its vapour in air to which it is believed that personnel may be exposed under certain circumstances without suffering adverse effects. Various governmental bodies publish TLVs. These should not be regarded as the absolute dividing line between safe and hazardous conditions. It is good operating practice to keep all vapour concentrations to a minimum and a safe margin below the TLV.

The best known list of TLVs is issued by the American Council of Governmental Industrial Hygienists (ACGIH). The values are updated annually in the light of new knowledge, so it is important to refer to the latest edition. The ACGIH defines three categories of TLVs:

- **TLV - TWA (Time Weighted Average)**: the concentration of vapour in air which may be experienced for an eight hour day or 40 hour week throughout a person's working life. This is the most commonly quoted TLV.

- **TLV - STEL (Short Term Exposure Limit)**: the maximum concentration of vapour in air allowable for a period of up to 15 minutes, provided that there are not more than four exposures per day and at least one hour between each. It is always greater than the TWA. It is not given for all vapours.

- **TLV - C (Ceiling)**: an absolute maximum which should never be exceeded. It is given only for fast acting substances. This is the highest of the three values for a given substance.

**Precautionary principles**

Containment is the first objective when any toxic substances are handled, by making sure that they stay inside the cargo system. Engineering and ship design features will provide a secure storage space. If there is no exposure there is no toxicity danger, however hazardous the chemical can be. Leakage of liquid or release of vapour must be prevented by keeping the cargo system closed unless it is absolutely unavoidable to open it.

However, some operations inevitably involve opening the system; for example, disconnecting a hose from the ship's manifold after transfer of cargo. Although this is a routine operation, it should be regarded as comparable to opening up a cargo line elsewhere on deck, and operators must wear the necessary personal protective equipment.

**Toxic vapour detection and personal protective equipment**

Most chemical vapours are heavier than air and tend to flow along the deck and accumulate in low spots, for example below pumproom floor plates. Therefore atmosphere samples should always be taken in such low points where concentrations are likely to be highest. It is important that a full chemical suit is worn by personnel when:

1. Inspecting pipelines and machinery for leaks;
2. Dealing with accidental leaks and spillage;
3. Connecting and disconnecting hoses and loading arms;
4. Taking ullages and samples from tanks (where restricted gauging is permitted);
5. Entering enclosed spaces such as pump rooms, cofferdams and tanks unless certified gas free;
6. Opening up pumps and equipment (unless certified gas free).

**IBC Code Requirements**

The IBC Code specifies ways to limit exposure of personnel to toxic vapours while cargo is being handled, or during carriage at sea.

First, it minimises toxic vapour emissions by controlling how cargo vapours are to be vented or returned to shore, and how tank contents are to be gauged. Virtually all toxic cargoes require closed or restricted tank gauges to prevent crews being exposed to unsafe concentrations of toxic vapours. Second, it specifies ventilation of working spaces such as pump rooms, requires the ship to carry equipment to detect vapours, requires the provision of personal equipment and, to ensure that toxic vapours are diluted to safe concentrations before they can reach accommodation areas, requires that tank vent system outlets are located at a safe distance. (The safe distances specified depend on the severity of the toxic hazard.)

Third, it reduces the likelihood of accidental overflow spills by specifying that all acutely toxic products and all allergic sensitisers are to be carried in tanks equipped with a visual and audible high level alarm (HLA). Tanks certified for the most severely acute toxic products must have a further overflow control system.

Finally, it specifies that cargo piping, including pumps, and venting systems of tanks carrying toxic cargoes are to be separated from those containing other products, to prevent any leakage causing toxic contamination of non-toxic products and subsequent exposure of personnel unaware of the contamination. This is achieved on many chemical tankers by having separate pumps, pipelines and vents so that segregation is achieved by design, and on ships with common pipeline systems by the engineering principle of two physical stops, such as spectacle plates or a removable spool piece and blank flanges.

Valve gland packing is the source of many small leaks. The correct packing material for the chemical being carried should always be used, and the glands correctly tightened.

The IBC Code prohibits stowage of most toxic products adjacent to oil fuel tanks. The combustion of many otherwise non-toxic chemicals may produce toxic substances such as carbon dioxide and carbon monoxide, fumes of hydrochloric acid, hydrogen cyanide and nitrogen oxides. These may be present at some distance from the fire and may have no warning odour.

Self-contained breathing apparatus should be used when dealing with chemical fires. The main danger from fume inhalation is asphyxia. Personnel affected by fumes should be removed rapidly to a fresh atmosphere, given oxygen and then treated appropriately as shown in the MFAG.
Medical

The two fundamental guides for medical first aid on board ships, which give advice on dealing with exposure to toxic cargoes, are the International Medical Guide for Ships (IMGS) and the Medical First Aid Guide for Use in Accidents Involving Dangerous Goods (MFAG). Both are published jointly by IMO, ILO (the International Labour Organization) and WHO (the World Health Organization). The IMGS gives guidance on common illnesses and is not solely concerned with chemical accidents. The MFAG is supplementary to the IMGS and contains advice for recognising and treating chemical poisoning, within the limits of the facilities available on board.

The general rule is that if, during the handling of chemicals, any person shows symptoms that suggest poisoning, they should be treated in accordance with the MFAG and seen by a doctor as soon as practicable. Medical advice should be sought by radio, while still at sea. Assistance may also be available from another ship with a doctor on board.

Emergency Treatment According to the Route of Exposure

Note that over and above the routine blood tests, as required under the crewing procedures, any crew member exposed to toxic chemicals must have their blood tested immediately after and then again as per doctor's advice.

How to recognize poisoning

MFAG gives directions on how to recognise the general symptoms of poisoning. Note that they may not appear for some time after exposure to the chemical. Symptoms to be alert to are unexpected headaches, nausea and vomiting, drowsiness, changes in mental behaviour, unconsciousness, convulsions, or pain. If the patient has a rapid but weak pulse, a greyish blue colour of the skin, severe breathing difficulty or remains unconscious for a prolonged period, severe poisoning must be suspected.

First aid and further care

A first aider is not just a person with goodwill, but a person with training. MFAG outlines immediate first aid, i.e. treatment for minor casualties, or to enable a victim to be moved so that further treatment can be administered.

The key priorities to remember when reacting to a casualty are:

- Send for help and inform the master;
- Do not become the next victim yourself: if the response is too big for you alone, then wait for back-up;
- Remove the victim from the danger or vice versa;
- Use breathing apparatus if there is any suspicion of toxic gases or vapours in the area.
The signs and symptoms of mild poisoning usually resolve after a few hours in the
majority of incidents, particularly if the degree of exposure is small. However, if a greater
amount is taken in, or the period of exposure is prolonged or the chemical is very toxic,
symptoms may persist for much longer, even for some days.

The patient's condition may continue to deteriorate even when clear of the source of the
vapour, and systemic affects may appear. Finally, the warning is given that death may
occur despite treatment.

General advice can be found in MFAG, on the emergency treatment to be administered
according to the way the chemical has entered the body, for example by skin or eye
contact, ingestion or inhalation. If the chemical has affected both the skin and the eyes,
the latter should get priority for attention. If the chemical has been ingested, the patient
should not be made to vomit because the vomit may enter the respiratory system and
add to the exposure problem.

MFAG tables

Appropriate reactions after exposure to the toxic cargoes listed in the IMO Codes are
given by tables in MFAG. There are 12 group tables, but five chemicals require their own
single substance tables, because they present particular combinations of toxic hazards
(carbon disulphide, allyl alcohol, benzene, acrylamide and tricresyl phosphate).

Emergency Schedules

The Emergency Schedules are an appendix to the IMDG Code and provide masters with
advice on the immediate action to be taken in case of accidents such as spillage or
leakage of toxic substances. In brief, if it is safe to do so, spillage should be collected for
subsequent disposal, but if there is any doubt, the spillage should be washed overboard
with plenty of water, because the safety of the crew takes priority over pollution
avoidance.

2.2.4 Reactive/Sensitive cargoes

Reactive/Sensitive liquids mean the liquids which cause the following phenomena
by self-reaction and reaction with water, air and other substances etc.

1. Generation of heat
2. Generation of vapor/gas
3. Rise of tank pressure
4. Deterioration of cargo liquids
5. Fire or explosion
6. Health hazards
7. Polymerization (self reaction)
8. Cause pressure to rise in the tank

A chemical may react in a number of ways; with itself, with water, with air, with other
chemicals or with other materials.

Self-reaction
The most common form of self-reaction is polymerisation. Polymerisation generally results in the conversion of gases or liquids into viscous liquids or solids. It may be a slow, natural process which only degrades the product without posing any safety hazards to the ship or the crew, or it may be a rapid, exothermic reaction evolving large amounts of heat and gases.

Heat produced by the process can accelerate it. Such a reaction is called a run-off polymerisation that poses a serious danger to both the ship and its personnel. Products that are susceptible to polymerisation are normally transported with added inhibitors to prevent the onset of the reaction.

An inhibited cargo certificate should be provided to the ship before a cargo is carried. The action to be taken in case of a polymerisation situation occurring while the cargo is on board should be covered by the ship’s emergency contingency plan.

**Reaction with water**

Certain cargoes react with water in a way that could pose a danger to both the ship and its personnel. Toxic gases may be evolved. The most noticeable examples are the isocyanates; such cargoes are carried under dry and inert condition. Other cargoes react with water in a slow way that poses no safety hazard, but the reaction may produce small amounts of chemicals that can damage equipment or tank materials, or can cause oxygen depletion.

Certain chemical cargoes, mostly ethers and aldehydes, may react with oxygen in air or in the chemical to form unstable oxygen compounds (peroxides) which, if allowed to build up, could cause an explosion. Such cargoes can be either inhibited by an anti-oxidant or carried under inert conditions.

**Reaction with other cargoes (Incompatible Chemicals)**

Some cargoes react dangerously with one another. Such cargoes should be stowed away from each other (not in adjacent tanks) and prevented from mixing by using separate loading, discharging and venting systems. When planning the cargo stowage, the master must use a recognised compatibility guide to ensure that cargoes stowed adjacent to each other are compatible.

As per the IMO code requirements (Appendix C.5.2 of IBC Code), Incompatible chemicals must be kept strictly separated from each other throughout the cargo containment and handling system, in order to avoid accidental mixing.

Separation should be achieved by having two barriers between the containment systems of the incompatible chemicals. The tank should be separated by a cofferdam, by an empty tank, a void space, a tank containing a mutually compatible cargo, or a piping tunnel. The piping or venting system for incompatible cargoes should be separated by removing a valve or spool piece and blanking off the exposed pipe ends, or installing two spectacle flanges with a bleeder or equivalent means to detect leakage in the pipe between the spectacle flanges.
Cleaning a tank and related cargo handling system should be performed thoroughly if consecutive cargoes are incompatible.

*It cannot be stressed too strongly that parcels of chemicals should not be accepted for shipment or loaded into ship unless positive assurance is available that the various chemicals are compatible within the segregation capability of the vessel.*

*The ultimate responsibility for the safety of the ship lies with the Master, who should ensure that the cargo distribution proposed for a voyage provides proper segregation or compatibility, using the data sheets of all chemicals to be loaded. If the data sheets fail to provide the necessary information, the Master should defer loading the cargo until consultation with the owner or other authority has produced satisfactory assurance that proposed segregation plan for cargoes to be loaded is safe.*

USCG Compatibility Chart

Several authoritative bodies have divided chemical cargoes into groups, defining criteria for incompatibility between groups, and have published list of incompatible cargoes. The most familiar is published by the US Coast Guard. According to this source, a mixture of two chemicals is considered hazardous (and the chemicals in question declared incompatible) when, under specified test conditions, the temperature rise of the mixtures exceeds 25 Degrees Celsius or a gas is evolved.

Whether cargoes within a pair of groups are incompatible is indicated in a table, known as the compatibility chart. It is important to note that, while the table gives general indications, the footnotes and data sheets for two particular cargoes should always be consulted because there are a number of exceptions to the compatibility chart.

Reaction with other materials

The materials used in construction of the cargo systems must be compatible with the cargo to be carried, and care must be taken to ensure that no incompatible materials are used or introduced during maintenance (e.g. by the material used for replacing gaskets). Some materials may trigger a self-reaction within the product. In other cases, reaction with certain alloys will be non-hazardous to ship or crew, but can impair the commercial quality of the cargo or render it unusable.

Heat adjacent

The maximum temperature of adjacent cargo permitted for each cargo to be loaded shall be obtained from shippers when handling heated cargo. In addition, care shall be taken to avoid indirect heating of adjacent cargoes and bulkheads during hot water washing of adjacent tanks.

Precautions for handling reactive liquids

a. Materials of cargo tank and cargo handling equipment are in conformity with the metal materials described in the “Material Safety Data Sheets”.
b. Maximum temperature of liquids shall be controlled by checking its temperature regularly.

c. Self-reactive liquids shall not be loaded adjacent to tanks containing liquids which need to be heated.

d. Substances which promote self-reaction of cargo liquids shall be completely removed from tanks to be loaded with reactive liquids.

e. When handling liquids added anti-polymerizing agent, the instruction book for anti-polymerizing agent shall be consulted and its usage and health hazards shall be well understood.

f. Liquids having dangerous reactivity with each other shall never be loaded adjacently. They shall be segregated from each other by cofferdam or same like void space.

g. Tanks loading liquids which have dangerous reactivity with each other shall be equipped with independent vent system respectively.

h. Chemical products shall never be loaded unless the master clearly assures himself that they are able to be loaded within the ship’s standard segregation system, causing no dangerous reaction among them.

2.2.5 Animal, Fish and Vegetable Oils and Fats

They are oils and fats extracted from animals, fishes and vegetables. Generally, they do not have any particular danger but some of them have the capability of absorbing oxygen and resulting in the oxidization. Due to this reason the cargo tanks which have been discharged of these cargoes will be deficient in oxygen due to the clingage of cargo in the tanks.

(1) Precautions for entering tanks after discharge of animal, fish and vegetable oils and fats.

a. No entry into tanks shall be allowed without the Chief Officer’s permission.

b. Before entering tanks, safety of entry into tanks shall be confirmed checking the oxygen content in tanks.

c. Checking of oxygen content in tanks shall be done at appropriate intervals during works in tanks.

d. Personnel shall always be positioned on deck near tank hatches during works in tanks.

e. Proper communication shall be maintained between the crew working inside the tanks and on the deck.

f. The enclosed space entry permit to be complied with (Ref Section 19.1.1 & Section 7.8)
2.2.6 High Melting Point Cargoes/High Viscosity Cargoes/ Solidifying Cargoes

High Melting Point Cargoes are heated to reduce unpumpables and to reduce load on the ships centrifugal pumps. They should be washed with a temperature above MP, with cold interface removed.

Chemicals have different thermal properties. Some will heat up very quickly, whereas others will require substantial heating, before any temperature gain is noticed. Similarly, those cargoes that heat quickly tend to cool down quickly, whereas the cargoes which heat slowly have far better heat retention properties.

The color too matters – white is a bad absorber and a bad radiator, while black is a good absorber and good radiator. These individual cargo properties should be recognized when heating cargoes on the loaded voyage. The length of the voyage must also be considered when deciding on heating schedules to avoid waste of fuel.

Unless instructions are given to the contrary, any “solidifying substance” should be maintained and discharged at a temperature of at least 10° above its melting point, to avoid pre-washing.

Stowage of cargoes with MP > 55 C must NOT be adjacent to cold interface lest the whole bulkhead gets a solidified thick film.

Should the cargo require it, heating coils can be opened to the tank, when the liquid is at a level of approximately one metre. This can offset cumulative list at berth – as for cargoes like Tallow.

If a cargo requiring heating is deemed dangerous/toxic leaks back to the engine room then “Dangerous/Toxic” return tank is required by BCH/IBC Code.

When loading solidifying cargoes, due regard must be made to ensure that lines do not become frozen. In any case, should stress and list/trim conditions allow it, the tanks furthest away from the manifold should be completed first, using a sequence of working towards the shortest pipe length. In manifolds with connections both port and starboard, the opposite side to loading generally gets frozen. This must be unblocked at sea before discharge port.

Company policy requires that no tank is loaded to a volume of greater than 98% at any time.

After loading high MP cargoes leave the pipelines open till the contents are drained properly. If proper written heating instructions are not received Master must Note Protest and informs the chemical operator.

If the tank is not blanketed with Nitrogen the sedimentation or build up at the tank bottom must be ascertained with sounding rod.
Charterers heating instructions must be obeyed and in any case heating increase must not exceed 5°C in a period of 24 hrs.

During cold weather the functioning of p/v relief valves should be checked regularly. It is possible that humid air vented from a cargo tank may condense and freeze thus inhibiting ventilation. This is also possible for cargoes with high melting point, such as Phenol, where cargo vapours could solidify in vent line.

For sediment / high MP cargoes ensure that the deep well impeller is not frozen by running the pump before arrival port with delivery valve shut.

When discharging a homogeneous heated cargo, the wing tanks should, as far as possible, be emptied before the centre tanks.

During the discharge, several tanks may be emptied simultaneously, however when the cargo sounding becomes around 1 meter discharge of such tank must be ceased temporarily. Final emptying, stripping and sweeping of the tanks must then happen one tank at a time.

The temperature in the tanks must be monitored and the heating must be adjusted in the tanks accordingly.

Never leave high MP cargoes inside the pipeline even for short periods like shifting barges etc. Check out if the common collector line will get frozen.

When vessels are carrying solidifying products it is important that the products are at the maximum discharge temperature (or slightly above) at least one week prior to arrival at the discharge berth. Also during this period once the product is up to required temperature, soundings must be made in each tank using a rod and line to determine if there are any solid products on the tank bottom.

In addition, any ballast in double bottom tanks beneath the cargo tanks MUST be lowered so that there is no direct contact between the ballast and the cargo in adjacent tanks.

Be aware of the slope of the pump delivery deck pipes towards the manifold. Some shipyards deliberately tilt the aft of manifold pipelines to avoid fitting superstrip lines. When loading high MP cargoes in winter from barges, any delay in between two barges can freeze cargo inside pipelines.

If the cargo goes below the steam coils and the surveyor makes a remark that there is unpumpable then the tank must be filled up again to cover the steam coils, reheated and then discharged again. Get tank dry certificate promptly—give notice to surveyor in writing in the pre-discharge CCR meeting.

After completion discharge of high MP pour point cargoes better to wash back lines using hot FW if feasible – compressed air is no use. In case of planned stop of high MP cargo in freezing weather keep the cargo recirculated. For recirculation of shore lines which can freeze discuss in the preloading meeting and agree in writing. Or you may have a condition where ship is blamed for cargo frozen in un-lagged or non-thermal jacketed portions of shore lines.
In order to make the tank cleaning faster and more efficient, the Master should always try to get the Dry Tank Certificate as the tanks get empty one by one —especially for drying veg oils and solidifying cargoes which jam the impeller and freeze the valves. Washing as soon as possible after receiving tank dry cert—and if the terminal allows it-- will prevent some solidification and save time.

During discharge the temperature of the cargo must be at least 10 degrees C higher than the pour point of the relevant cargo.

If vessel is discharging high MP cargoes the surveyor must be present at stripping/ sweeping time. If the discharge of high MP cargoes is stopped for any reason (shore tank changeover/ barge changeover/ shore leak), the connecting hoses and lines on deck must immediately be drained back into the tank in order to avoid the system being blocked by coagulated cargo.

Any ROB noted on the certificate is clearly marked and considered by all parties as “unpumpable and unreachable, non-free-flowing sediments / sludge”.

After discharging of vegetable oils / palm oils to prevent them from drying on the bulkheads, the bulkheads must be kept moist until the tank cleaning begins. In warm weather the drying process is fast and in cold / wet weather much slower. Hot cargo in adjacent tanks will make the residues dry very fast on the bulkheads.

Substances with a reasonable solubility (down to 0.2 %) will be removed with water. Be aware that the solubility of some chemicals increases with temperature. The wash water should be at least 15 C higher than the melting point of the cargo. For Caustic potash crystallizing point is 9C while for Caustic soda it is 12 to 15C. As per the IBC code prewash for substances which have a viscosity equal to or greater than 50 mPa.s at 20°C shall be washed with hot water (temperature at least 60°C), unless the properties of such substances make the washing less effective.

**MP of a few cargoes in deg C:**

Coconut oil/ 14-28 C

Lard/ 33-46

Hydrogenated corn oil/ 28-35

Hydrogenated rapeseed oil/ 28-38

Palm oil/ 23-50

Tallow/ 35-50

Peanut butter/ 23-45

Cresol/ 11-35

Dichlorobenzene/ 35
Fatty alcohol/ 3 -40
HMD/41
Naphthalene/ 80
o-Nitrochlorobenzene/ 33
Paraffin wax/ 55-60
n-Pentane/ 36
Phenol/ 41
Polyisobutylene PIB/ 90
TDI/ 20
Trichlorobenzene/ 15
Undecyl alcohol/ 15
Paraxylene/ 13

Some cargo residues have very high MP which makes them difficult to emulsify. To clean such residues it may be necessary to use a solvent like toluene.

The cleaning of PV vent lines is best done with live steam.

Pre-cleaning non-drying fats with hot water is best done after first steaming the tanks

Washing pressures and temperatures must be maintained together and must not be adjusted to compensate for either a loss in temperature by reducing the pressure and/or the number of machines. If a problem is experienced with a loss of heat, then washing may be continued, but the washing time should NOT count until the required temperature has been reached again.

In the pre-planning stage, a proposed time scale (bar chart) must be formulated, to provide fore warning for the engine room. The Chief Officer must also try to ensure that once pressures and temperatures have been reached, they should be kept as constant as possible, without undue fluctuations. This will avoid major fluctuations and associated problems in the engine room.

Temperature of the cleaning solution must be 20 C > MP of the cargo. Temperature of the cleaning solution must be 20 C > MP of the cargo.

Avoid rapid changes of temperature especially in cold weather will adversely stress the ship's structure.
When cargoes with high wax content are carried, care must be taken that temperatures are not allowed to drop below flocculation/wax precipitation temperature as wax will not revert back into solution no matter how much the temperature is increased.

Hence if the actual loading temperature is considerably different from the specified loading temperature the Master must protest in writing. In cases of extreme temperature difference the Master may at his discretion, cease all loading operations until the matter is resolved. Keep the Chemical operator informed.

When calculating the bunkers required for cargo heating a reserve quantity of bunkers shall be included in the total to guard against voyage delays due to adverse weather or unforeseen climatic conditions.

Heating required by Marpol Annex II

Category Y, high Viscosity and solidifying cargoes may require prewash, if not heated. These cargoes do not require a prewash if the following is complied with:

Category Y Cargoes with a melting point less than 15°C.

Discharge temperature should be at least 5°C above melting point of the product. Example: Benzene with a melting point of 4.5°C should be discharged with a temperature of at least 9.5°C. to avoid the prewash requirements.

Category Y Cargoes with a melting point above 15°C.

Discharge temperature must be at least 10°C. above melting point of the cargo. Example: Phenol, with a melting point of 40.9°C. should be discharged with a temperature of at least 51°C. in order to be considered not solidifying.

Category Y Cargoes with Viscosity < 50mpa at discharge temperature

The Master has to obtain the shipping document with above information from shipper when transporting such cargoes so that the products will be heated accordingly so as to avoid the prewash obligation if at all possible.

Temperature checks

When carrying heated cargoes the following parameters are to be checked regularly:

1. Temperature of the cargo at 3 levels
2. Inflow temperature of the heating medium (or steam pressure)
3. Outflow temperature of the heating medium (or steam pressure)
2.2.7 High Density Cargoes

Stowage of a nominated cargo in the ship's cargo tanks must be executed in strict compliance with the vessel's loading manual. When the vessel is instructed to load a high-density cargo (i.e.: negative API / density more than 1.0 kg/cm²), the Master must ensure that the following procedure is adhered to strictly when preparing the load plan:

The height of the high density cargo within the tank should be reduced, so that the pressure exerted at the bottom of the cargo tank by the high-density cargo will not exceed the pressure exerted by the full loaded (98%) cargo of unrestricted loading density i.e.: \( h_{1d1} = h_{2d2} \), where \( h_1 \) = Height of high density cargo, \( d_1 \) = Density of high density cargo, \( h_2 \) = Height of unrestricted loading density cargo when tank is filled up to 98% and \( d_2 \) = Unrestricted loading density.

The following formula may be referred to when calculating the filling ratio for a tank:

\[
\text{Filling ratio} = 100 \times \frac{\text{Maximum density to which the tank can be loaded full}}{\text{Cargo Density}}
\]

Nevertheless, in case of a vessel being nominated to load a high density cargo, the head office will consult with the concerned Classification Society before the vessel is confirmed to load the cargo.

Further to above the following to be adhered to:

1. Stress, stability, trim and list
2. Certificate of Fitness (check the list of chemicals attached to the certificate and confirm that the ship is certified to carry the cargo)
3. IBC/BCH Code to be referenced and the carriage requirements of the cargo noted along with IMO classification etc
4. Charterer’s requirements for the cargo
5. If more than one tank is required, the total volume of the tanks chosen should as near as possible be the same, but not less than, the total volume of cargo, keeping dead space and ullage to a safe minimum.
6. Certificate of Class to be cross-checked for ensuring chosen tanks have sufficient strength for high density cargoes
7. Tank coating compatibility
8. Shipping Documents for each cargo to load
9. MSDS for each cargo
10. Antidotes and Toxic Gas detectors for the cargoes being handled as applicable
11. Crew familiarity with the cargo to be handled
Cargo Quantities

The cargo quantities are planned and checked in relation to the voyage orders with regard to:

1. Loading capacity (load calculation)
2. International Load Line Zones in trading area
3. Sheer force and bending moment stresses during the various stages of loading and discharging
4. Draft and passage limitations en route, canals and in ports of destination

Filling limits of cargo tanks

Following to be taken into account for determining the filling limits of cargo tanks:

1) Load density limit of cargo tanks against cargo density

2) Density of cargo at maximum voyage temperature or discharge temperature against load temperature

3) IBC code limit of cargo quantity for ship Type 1 and 2 tanks.

4) FOSFA restrictions for minimum filling limits (>60% volume in order to consider last cargo) the filling limits of the cargo tanks due to temperature variations and overfill limits shall be complied with as per IBC code. In additions vessel shall comply filling limit restrictions due load density limits of cargo tanks as per Certificate of Class and Stability manual.

Stowage Limitations of Cargo Tank Structure and Fittings on Chemical Ships

Attention should be paid to stowage limitations due to cargo tank structures and their fittings, i.e. the specifications of a cargo tank will limit product weights and quantities which can be loaded in that tank. Refer to ship specific Certificate of Fitness, also the BCH/IBC Codes, for lists of cargoes and tank types suitable for their carriage.

2.2.8 Cargoes generating an electrostatic charge

Static electricity is generated by friction that occurs between different materials during relative motion. Electrostatic charges can then accumulate in materials which are poor conductors of electricity or which are good conductors but are insulated. If two such bodies with accumulated static electricity charges are brought close together, and if the difference of potential is great enough, the accumulated charge will jump between them.

The primary concern about static electricity is the possibility of generating an incendive spark within a flammable atmosphere. Inerting a tank can prevent the existence of a flammable gas mixture so that no hazard will exist.

Static electricity can be generated due to the passage of a liquid through a hose or pipeline, and turbulence within a tank. In normal circumstances the charge generated is
released instantaneously to earth (the ship’s structure) because the liquid conducts it, and design features of cargo tank internals will avoid its build up.

Problems from static electricity are most likely to arise when loading cargoes known as static accumulators, often highly refined petroleum products. It is important, quite apart from cargo quality requirements, to make sure that lines which have been flushed with water have been thoroughly drained and that the bottom of the tank is dry before starting to load a static accumulator cargo.

At the initial stage of the loading operation, it is important that the loading rate is limited. Until the bottom longitudinals and tank suction are covered, loading speed of the liquid in the pipeline should not exceed a linear velocity of 1 metre per second (m/s), which corresponds to the following loading rates:

**Pipeline diameter Loading rate:**

- 200 mm - 115 cubic metres per hour
- 150 mm - 65 cubic metres per hour
- 100 mm - 30 cubic metres per hour

Thereafter, loading may be increased to a maximum pipeline speed of 7 m/s. Experience indicates that hazardous potentials in respect of static electricity do not occur if the velocity is below 7 m/s. However, where well documented experience demonstrates that higher velocities have been safely used, an appropriately higher limit than 7 m/s may be employed.

**The process of static electricity may happen in a chemical tanker in 5 different steps:**

1. An electrostatic charge is generated in the liquid as it flows turbulently through the loading pipeline into the ship’s tank. In most liquids the charge is released instantaneously to earth because the liquid conducts it.

2. But in some cases, the charge is accumulated in the liquid because the liquid has a low electrical conductivity. Such liquids are called static accumulators, and are generally found among more highly refined products. An electrostatic field is formed inside the tank.

3. A non-bonded projecting object, or something introduced into the tank, can become a potential electrode or spark promoter, collecting the charge from the liquid.

4. When close enough to an earth the spark promoter instantaneously releases its charge in a spark through the atmosphere of the tank.

5. Such a spark will almost certainly have enough energy to ignite a flammable vapour. In chemical tanker operations, a flammable atmosphere may be unavoidable.
Static electricity when loading
Certain materials have the potential to accumulated static electricity charge. This is usually as a result of physical activities that have taken place with or around the material.

Contact electrification in fluids depends upon the presence of ions or small charged particles. A flowing liquid in a pipe has a certain velocity profile; due to friction at the pipe wall the fluid there will have a lower velocity profile compared to the centre of the pipe. Positive charged particles inside a liquid will be attracted to the grounded metal duct wall and will end up in the liquid film at the pipe wall flowing with lower velocity. The negative particles end up in the inner part of the liquid stream. The moment the liquid flows out of the pipe the positive charge present in the slower moving film at the pipe wall will flow back to the grounded pipe wall. The inner liquid, moving faster and containing negative charge, cannot flow back and flows off with the liquid into, for instance, a cargo tank.

On board our vessels we are working with materials and cargoes that have the potential to accumulate static electricity. Of course all seafarers are trained on this subject and know how to avoid static electricity climbing to a dangerous level.

Possible consequences
All petrochemical products with an electrical conductivity of less than 50pS/m (=pico Siemens/metre) are so-called non-conductors, and are considered to be capable of generating spark hazards. After many studies it is determined that during handling of a static accumulator cargo, the product may pick up sufficient charge to constitute a hazard.

Avoiding sparks is top priority, but where and how can they originate?
In daily life, when walking across a carpet, electrons move from the rug to you. Now you have extra electrons. Touch a door knob and “ZAP”! The door knob in this case is a conductor. The electrons move from you to the knob, causing you to receive a shock.

In fact the same could happen onboard vessels, for example when we would like to take a cargo sample or on surveyors request take ullage with a metal ullage tape. If non-conducting equipment is used like a synthetic fibre rope attached to a sampling cage or an ullage tape not properly bounded, the non-conductivity may create a hazardous situation.

The sampling cage can be charged by induction if suspended via a non–conductor, like the synthetic rope. A non-conductive rope can also be charged by rapidly slipping throw gloved hands for appreciable distance. By this an insulated person can also become charged. Conductive sampling and gauging devices should therefore be used with a conductive lowering device e.g. tape and cable.

To avoid a dangerous situation, conductive sampling and gauging devices should be properly bonded to the tank by means of bonding cable or by maintaining continuous metal to metal contact between the lowering device and the cargo tank hatch. If it touched the metal of the tank, the tank wall and sampling can or dip rod are at the same potential.

If we bring this theory back to our day to day work on board our vessels we are able to determine that static electricity by lowering metal device in cargo tanks or loading or discharging conductive cargoes can be of a great risk. This electrostatic charge will be
discharged either to an earthed (grounded) item or between items having differing potentials.

**Ten golden rules to avoid static electricity**

1. The most important countermeasure to prevent electrostatic hazard is to bind all metal objects together to prevent potential differences.

2. On board of chemical tankers it essential that the initial loading rate for non-conductive cargoes is below the 1 m/s until the liquid level reaches about 30 cm in the cargo tank. The maximum loading rate should never exceed 7 m/s.

3. Avoid splash filling in the cargo tank.

4. Don't use cleaning agents like Toluene which has a conductivity > 50 pS/m.

5. Cleaning devices like tank wash machines, portable fans and hoses lowered in the cargo tank after discharge must be conductive and bonded to the tank. Hoses for cleaning purpose must be tested for electrical continuity and the resistance should not exceed 6 ohms per meter.

6. The body can store an amount of energy in excess of the ignition energy for hydrocarbons. Body potential of 10-50 kV can be attained by individuals. When handling flammable liquids one has to take in account that clothing might be a source of ignition. In zone 0, an area in which a flammable gas mixture is continuously present or is present for long periods, and zone 1, an area in which there is likely to be a flammable gas mixture under normal operating conditions, the following precautions must be taken:
   - Avoid synthetic clothing;
   - Do not change clothing in zone 0 and 1 areas, especially in cold areas;
   - Wear antistatic shoes.

7. A ship/shore bonding cable is not effective as a safety device and may be dangerous and should be avoided. Terminal regulations may require a ship/shore bonding cable to be connected, however note that maximum resistance to earth is 10 ohms. If such cable is insisted upon, it should first be visually inspected to see, as best possible, that it is mechanically and electrically sound. The connection point for the cable should be well clear of the manifold area.

8. After loading minimum waiting time of 30 minutes must be adhered before cargo tanks are opened for sampling and ullaging.

9. Radio transmission (300 kHz – 30 MHz) radiates significant energy is radiated which can, at distances extending to 500 meters from the transmitting antennae, induce an electrical potential in unearthed receivers like for example mast stays or cranes.
   - Transmission on the above mentioned frequency is not allowed during the periods when there is likely to be flammable gas in the region of the transmitting antennae.
- VHF and AIS and Satellite transmission normally have low energy transmission and do not produce the same source of energy. Although it must be reminded that the VHF and the AIS must be switched to low power (1 watt) in the port region.

10. All personnel involved in the handling of static accumulators must be made aware of the risks associated in handling non conductive cargoes.

### Non conductive or static accumulators

Certain cargoes are known as “Non Conductive or Static Accumulators”. These are cargoes with a typical conductivity below 50 pS/m. Table below present value and classification for a range of cargoes classified as “Static Accumulators” For more detailed description of Static Electricity, see Isgott Ch. 3.

Other cargoes not on the list may also be classified as static accumulators.

<table>
<thead>
<tr>
<th>Product</th>
<th>Typical conductivity pS/m</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Conductive</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Xylene</td>
<td>0.1</td>
<td>Accumulator</td>
</tr>
<tr>
<td>Gasoline (straight run)</td>
<td>0.1 - 1</td>
<td>Accumulator</td>
</tr>
<tr>
<td>Diesel (Ultra low sulphur)</td>
<td>0.1 – 2</td>
<td>Accumulator</td>
</tr>
<tr>
<td>Lub Oil (Base)</td>
<td>0.1 – 1000*</td>
<td>Accumulator</td>
</tr>
<tr>
<td>Commercial Jet fuel</td>
<td>0.2 – 50</td>
<td>Accumulator</td>
</tr>
<tr>
<td>Toluene</td>
<td>1</td>
<td>Accumulator</td>
</tr>
<tr>
<td>Kerosene</td>
<td>1 – 50</td>
<td>Accumulator</td>
</tr>
<tr>
<td>Diesel</td>
<td>1 – 100*</td>
<td>Accumulator</td>
</tr>
<tr>
<td>Cyclohexane</td>
<td>&lt; 2</td>
<td>Accumulator</td>
</tr>
<tr>
<td>Motor gasoline</td>
<td>10 – 300*</td>
<td>Accumulator</td>
</tr>
</tbody>
</table>

* Some additives used for performance improvement can increase conductivity significantly
2.3 Cargo handling operation

2.3.1 Guidelines on Cargo Planning

Chemical data sheet means a document, in accordance with the IMO Codes and usually from the manufacturer of the cargo, (Cargo Information Form) that contains necessary information about the properties of the chemical for its safe carriage as cargo. Careful study of such data sheets are essential in cargo planning of various chemical cargo, safe stowage and any segregation requirement etc.

Every chemical tanker must have a Procedure and Arrangements Manual that gives Procedures for compliance with Marpol Annex II when noxious liquid substance cargoes are handled on board. The following sequence outlines a general cycle of operations, and supplementary comments are made where relevant.

- Preparation for cargo loading
- Inerting/purging
- Loading
- Transport
- Preparation for discharge
- Discharge
- Ballasting
- Tank-cleaning/gas-freeing.

Outlined below some needful guidance for handling various noxious liquids should be considered as general guidance only, as there are considerable variation in the design of cargo containment and cargo handling systems.

The cargo containment and handling systems have been designed and constructed in accordance with the requirements of the IBC/BCH codes, the SOLAS convention and the MARPOL 73/78 convention to safely transport and handle the chemicals the ship is certified to carry.

However, the required levels of safety in cargo-operations can only be achieved if all parts of systems and equipment are maintained in good working order. Similarly, the personnel involved in cargo operations must be fully aware of these instructions, their duties and be thoroughly trained in the correct procedures and handling of the equipment.

Before and during all operations involving the cargo, ballast and bunkering systems, the Master must ensure that the precautions required by the company safety management system and relevant checklists are fully observed.

Reference is to be made to the publications listed in section 1.4 of the manual as well as equipment operating and instruction manuals.

Each vessel, which is certified for the carriage of noxious liquid substances (NLS) in bulk, is provided with a Procedure and Arrangements Manual (P & A Manual). All substances permissible for carriage onboard are listed in this manual and are approved for and on
behalf of the flag state government that the vessel is registered under, usually by Classification Society acting on its behalf.

The purpose of this Manual is to identify the arrangements and equipment to enable compliance with Annex II of MARPOL 73/78 and to identify for the ship's officers all operational procedures with respect to cargo handling, tank cleaning, slops handling, residue discharging, ballasting and deballasting, which must be strictly followed.

If the vessel has been nominated to load a cargo that is not listed in the P&A Manual, this should be notified to the vessel's operator. They will then liaise with the Class Society to determine whether a note of acceptance or a dispensation is possible for this cargo.

The details of permissible substances for carriage onboard are detailed in an attachment to the 'Certificate of Fitness', which is also issued by the flag state and usually delegated to Classification Society acting on its behalf.

The P&A Manual must be updated as necessary to reflect any changes to the vessel's structure; tank coatings etc and any alterations to the Manual are to be Class approved. A check list is given below, which to be referred to when discussing cargo planning in your ship.

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 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 tank. The general rules are: Zinc silicate coatings are resistant to strong solvents (aromatics, alcohols, ketones etc). Zinc silicates are not resistant to caustic soda or alkaline cleaning chemicals.

Epoxy coatings are resistant to petroleum products, caustic soda, vegetable oils, wine, seawater, fatty acids, limited resistance to alcohols and aromatics.

Coal tar epoxy is resistant to sea water, crude oil and petroleum products in general but should not be used for jet fuels or light oils 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 contaminations. 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.

9) After cargoes with a strong odour (fish oil, phenol, octanol, tall oil, turpentene, molasses), the tanks should not be used immediately for odoursensitive 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 naphtha 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.

It should be borne in mind that individual ship has got own characteristics and limitations may involved handling various chemical cargoes. The master and all personnel in all cases must be aware of cargo/ship information that has been given and comply with relevant safety procedures.

The following reference publications provide useful information while planning cargo:

- SOLAS (latest consolidated version)
- MARPOL 73/78 (latest consolidated version)
- International Safety Guide for Oil Tankers and Manuals (ISGOTT)
- ICS Tanker Safety Guide (Chemical)
- Procedure and Arrangements Manual (Approved by Class)
2.3.2 Loading operation

Loading operation shall be done in accordance with the “CARGO OPERATION MANUAL” prepared by the yard and approved by the Class for the vessel taking into account the following items.

1. Investigation of cargoes to be loaded
   The Chief Officer shall investigate the items listed below in planning the loading plan.

   c. Compatibility of cargoes
      Compatibility of cargoes shall be checked with the “IMO CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK” or “INTERNATIONAL CERTIFICATE OF FITNESS FOR THE CARRIAGE OF DANGEROUS CHEMICALS IN BULK”.

   b. Properties and hazards of cargoes
      Properties and danger of cargoes shall be investigated with “OPERATION MANUAL DATA SHEET”, “CHEMICAL DATA SHEET (USCG)”, “CHEMICAL HANDLING MANUAL (NKKK)”, “CHEMICAL 800 (NKKK)” and “MATERIAL SAFETY DATA SHEETS”

   c) Loading plan
      Taking in account the factors listed below, the Chief Officer should make a safe and efficient loading plan submit it to the Master for approval.
      a. Quantity and type (by IMO) of cargoes
b. Strength and coating compatibility of tanks

c. Relative position of toxic cargoes and accommodation space

d. Segregation of cargoes reacting with heat from heating cargoes

e. Necessity of sealing up cargoes with Nitrogen

f. Restrictions on loading edible oils due to previous cargoes. (FOSFA Banned List)

g. Applicable load lines according to the “Chart of Zones and Seasonal Areas”

h. The deadweight corresponding to the above and available cargo capacity of the vessel

   The cargo quantity to be loaded should be planned so that 98% of the tank capacity may be utilized at the maximum temperature expected while loading/discharging and while at sea.

   (In the case of cargoes which require heating, allowance should be made for expansion due to heating.)

   Conditions of ports and trade route

   Available depths of water, permissible draft or under keel allowance, specific gravity of the sea water, and tides at ports, harbours, berths, straits, rivers and canals.

j. Filling limits of cargo tanks on their designed Specific Gravity

   Max. filling ratio(0/o full)= DSG / SG x 100

   DSG: the designed Specific Gravity of the cargo tanks

   SG: the Specific Gravity of the cargoes to be loaded

k. Filling limits of cargo tanks on their sloshing strength. In general, partial loading between 20% and 80% of filling ratio shall not be adopted to avoid an excessive sloshing load on the tank structure.

   However. If partial loading is involved in the intended plan, cargoes should be laded to the extent of a safe loading percentages as determined after referring to the sloshing calculation shown in the vessel’s “LOADING OPERATION MANUAL”

l. The “LOADING OPERATION MANUAL” approved by Class shall be referred to. (including trim/stability calculation)

m. Loading manual on the ship’s survival stability in damaged condition required by IBC Code shall be referred to.

n. Cargo suitability/resistance table for coated cargo tanks

o. Hull strength

   On the basis of the loading manual provided for each vessel, calculations should be made of stresses to be imposed on each part of the hull after loading, to ensure that such stresses are within the permissible range of safety. Stress should be considered so that the hull stress is kept within the permissible range not only after the finish of cargo loading but also during the loading and discharging operations. Draft and trim should also be appropriate.

   The result of the calculations should be recorded and retained on board.

p. Loading rate

   The maximum loading rate acceptable for the vessel or for each tank should be determined by the following factors, as well as the current condition of the ship’s facilities and the experience and
capabilities of the crew members concerned, with reference to the loading manual:

1) Number of tanks to be loaded
2) Loading rate corresponding to the maximum flow rate of 7m/sec for cargo to pass through the ship’s pipeline (including the manifold)
3) Loading rate corresponding to the maximum flow rate of 38m/sec for the gas inside tanks to pass through the vent line

(3) Preparations before arrival at loading port. Check and carry out operational tests of cargo handling equipment and instruments:

a. Checks of gas leaks through openings on deck and vent systems. In calm weather conditions while at sea, gas leaks from openings such as tank cleaning holes, tank hatches, ullage holes and any other opening must be checked for leaks, if any, must be stopped with the necessary measures taken, e.g., tightening the relevant bolts and nuts and replacing packing.

b. Operational test of tank level gauges
   An operational test should be made on the level gauges to check the matching of the readings shown locally and remotely in the CCR, the normal function of high/overfill and low level alarms; and the results be recorded.

c. Check of heating coils
   Heating coils for cargo heating should be pressure tested by steam or compressed air of more than 7kg/cm² on a regular basis and the results of tests should be recorded. The leaking steam coils should be blanked off and this information should be maintained in the records and displayed in the CCR.

(4) Loading procedures
a. Meeting with shore responsible person prior to the commencement of cargo operation
   The Chief Officer must discuss the following matters with the shore responsible person on the basis of the loading plan.
   1. Information on safety, including the terminal safety regulations and safety checklist. The Chief Officer must fill up and comply with the ISGOTT safety check list including chemical requirements even if terminal does not have one.
   2. Designation of smoking places
   3. Restrictions on the use of fire and cooking devices in the galley
   4. Items which require the posting of notices
   5. When operations which involve hot work or other repair work are conducted on board the vessel or in the shore facilities, such place and method
   6. Means and methods of communication between the vessel and terminal.
   7. Emergency measures (emergency shut-down procedures)
   8. Designation of access doors to the accommodation spaces.
9. Kinds and expected quantities of cargoes and loading sequence. Loading must be commenced only after complete agreement on the cargo to be handled is reached between the Chief Officer and the terminal responsible person. If there are discrepancies between the instructions given by the charterer or the Company and requirements made by the terminal, the charterer or the Company should be contacted to clarify the situation before the commencement of the operation.

10. Matters concerning slops.

11. Loading rate upon the commencement of loading, maximum allowable loading rate and loading rate for topping off and procedures to change over to a different kind of cargo.

12. Confirmation of whether cargo loading is ordered to stop by the shore or ship's responsible person, the stand-by period required for ordinary stops, and the amount of cargo which flows in after the order to stop loading.

13. Discharge or loading of ballast water, its quantity and required time.

14. Details or cargo (e.g., temperature, water content, properties, precautions in handling, and loading plan).

15. Matters concerning the ship's facilities (e.g., the pump capacity, and the present condition of the inert gas system, tanks and pipes)

16. Matters concerning shore facilities (movable scope of the loading arm, connecting/disconnecting method, present state of pipes and tanks)

17. Matters concerning the procedures to measure the quantity of cargo, taking samples, take temperatures and take water cuts.

18. Matters concerning restrictions, e.g., on the height of the ship's manifold above the water (height of the bow fair-lead), draft and trim.

19. Schedules and quantities of bunker oil and water to be supplied.

20. Additional matters which require confirmation concerning cargo work and safety.

b. Inspection of cargo tanks before loading (dry inspection).
   The duty officer, under the direction of the Chief Officer, must check and confirm that the cargo tanks have dried up in the presence of the terminal responsible person or cargo surveyor.
   After the inspection, a dry certificate must be prepared and signed by the terminal responsible person or cargo surveyor.

c. Procedures when commencing loading operations
   1. The Chief Officer must confirm before the commencement of cargo work that the cargo system (valve handling) is correctly lined on the basis of the loading plan.
   He must attend in person the commencement and finishing of the loading operation.
The position (open or closed) of valves should be checked, and the cargo loading system set up by observing the following:

1) The closure of all valves (hydraulically driven or hand-operated) on the cargo lines, ranging from those operated at the console in the CCR at local stands in the pump room and on the upper deck, to hand-operated valves, as a rule, should be checked. In the case of valves which have been kept open, in consideration of thermal expansion inside the pipes, such valve positions should be confirmed.

2) The cargo line valves for loading should be opened in sequence, from valves close to the manifold gate valve toward the cargo tank to be loaded via intermediate valves, including jumping valves, drop valves and bottom line bypass valves. The closure of the deck Master valves and other valves leading to cargo lines which are not used should be confirmed.

3) The suction valve for one tank among those to be loaded should be opened. The manifold gate valves should be opened lastly after the line-up for loading is completed and the approval of the terminal is obtained.

2. The Chief Officer must check in person the open or closed position of the valves and fitting conditions of blank flanges and post crew members at specified locations in order to make the vessel ready to take action in response to the request of the shore to commence loading.

3. Cargo should be loaded at a minimum rate upon the commencement of loading. After checking that no cargo is leaking, no excessive stress imposed throughout the loading system, including the pipe line and manifold, and cargo is being properly transferred, the loading rate must be gradually increased to a maximum agreed between ship and shore.

4. When commencing cargo loading, the Chief Officer must pay attention to the number of cargo tanks to be loaded at the same time, with the motto "Safety first" in mind, to avoid excessive pressure on the relevant cargo lines and valves.

5. The Chief Officer must station a crew member who is able to communicate with terminal personnel, in the vicinity of the manifold to monitor the situation upon the commencement of loading operations, and ensure that he checks and reports the inflow of cargo, manifold pressure and temperature, also cargo leaks from the connections so as to provide against emergency situations.

6. When cargo handling operations are commenced or resumed on board a vessel with trim, it must be taken care to monitor differences in liquids levels in cargo tanks to avoid overflow. When loading is suspended temporarily, the suction valves for tanks which contain cargo must be securely closed to prevent overflows as a result of shifting of cargo from tank to tank.

d. Discharge of ballast water for arrival

1. The discharge of water ballast must always be made, in any case, under sufficient surveillance by complying with the procedure
specified in Chapter 4 "Handling of Water Ballast", to prevent the pollution of the sea.

2. Even in the case of de-ballasting from a segregated ballast tank, cargo may mix into water ballast through holes of the pipe lines or bulkheads. The sea surface in the vicinity of the discharge opening should be monitored at regular intervals during de-ballasting operations. At this time, Attention must be paid to the difference in the head height between the cargo tanks, ballast tanks and sea water.

e. Monitoring of ullage
   1. The ullage of every tank must be monitored during cargo handling operations to prevent overflows. And efforts must be made to detect unusual conditions, including leaks from valves, at an early stage. It must be monitored at least once every hour and the loaded cargo quantity of each tank should be calculated to see whether the cargo work has progressed according to the loading plan and such figures to be recorded. When the ullage space has become less, it requires continuous monitoring.

   2. On board vessels where ullage is monitored with remote level indicators in the CCR, the readings of the indicators must be checked to see that they show correct figures before crew members become constrained by time at the final stage of loading cargo.

   In the case of vessels equipped with float type level gauges, they should be checked to see that they properly function without sticking.

   3. When the completion of loading is drawing near, every precaution should be taken to prevent overflows by taking proper measures, e.g., reducing the loading rate.

   For this reason, communication with the terminal responsible person must be ensured so that sufficient care is taken in the operation of the valves and pumps on the terminal side.

   4. Close attention must be paid, during cargo handling operations, to the ullage of tanks which are not under loading operation, to prevent unforeseen accidents caused by leaks of valves and pipe lines.

   5. Even ullaging devices for the tanks which are not under loading operation may not be stopped until all operations are completed.

f. Topping off
   1. In the final stage, loading operation should be adjusted, to prevent overflows and to take into consideration the allocated manpower, so that tanks may be topped off one by one by avoiding simultaneous operations at more than one tank.

   In addition, with the decrease in the number of tanks being loaded, the rising speed of the cargo level increases, which requires slowing down of the loading rate in sequence.
2. A center tank in the midships section should preferably be selected as the final tank to be topped off, so that loading in the final stage may not affect the trim or heel of the vessel.

3. Before topping off the final tank, the approximate or final gravity should be obtained from the terminal to calculate the loaded cargo quantity using drafts, cargo temperatures and ullages, to adjust the ullage of the final tank.

4. When the final tank is to be topped off, the Chief Officer should ensure that the loading rate is reduced to a minimum and that the terminal is on stand-by, ready to stop loading at any time. He should also ensure that crew members report the ship's draft and the ullage of the relevant tank, so as to give a stop order so that the vessel may load the intended cargo quantity.

5. When the expected ullage for the final tank is small, an empty tank or a tank with a large ullage should be identified so that it can be used in an emergency case by opening the suction valve of the very tank to receive cargo oil, thereby preventing overflows. In order to prevent damage to the cargo transfer system between the shore and the vessel due to pressure surge effect, the tank suction valves must not be shut off against the cargo pressure before the notification that the cargo transfer has finished, is received from the terminal, even if the cargo has been loaded in excess of the expected quantity.

6. Even after the loading is finished and there is no inflow of cargo, the ullage should be monitored until the rise of the cargo level settles, since the cargo contained in the cargo lines on deck, drains into the final tank.

g. Finishing of cargo loading operation
1. When finishing cargo loading operations, the ship's valves should be shut only after the shore valves have been confirmed to have been shut.

2. After the finish of the loading operation, the disconnection of cargo hoses or arms must be carried out in the presence of the Chief Officer or his substitute. Close attention should be paid to prevent cargo spilling upon disconnection by, e.g., opening drain valves to drain remaining cargo in the hoses or arms before disconnecting them.

3. After the finish of cargo loading, the manifold gate valves should be closed and then the cargo remaining in deck lines should be cleared into tanks, as far as possible, by opening air inlet valves or drain valves. Each valve should be closed thereafter.

4. It should be ensured that tank openings such as ullage holes, and the vent riser valves are closed.

h. Cargo measurement, water cut, etc.
After the finish of the loading operation, the duty officer, together with the cargo surveyor, under the direction of the Chief Officer, should measure the cargo quantity in the loaded tanks, take water cuts and temperatures, and make an ullage report. He should calculate the loaded quantity of
each tank by using the cargo temperature and volume reduction of each tank and enter the results in the ullage report.

Tank openings, including ullage holes, should be opened only when they are used to take measurements and temperature, and to be closed immediately thereafter.

1. The measurement of the cargo quantity should be taken as follows:
   1) After the completion of cargo loading, measurements should be taken of all tanks where cargo has been loaded. The gauging equipment should be in good working order.
   2) On board vessels equipped with float gauges or radar echo type gauges, attention should be paid to ullage readings; if they involve errors, such errors should be recorded in the "Table of comparison between actual ullage and float gauge" and cargo work should be carried out with the errors in mind. The gauging devices should be adjusted to eliminate errors after the completion of cargo work.
   3) The measurement may be taken by sounding or ullaging and the cargo quantity calculated by using tank tables provided on board the vessel. Measurements should be taken up to accuracy of 0.5cm. in most terminals closed loading and sampling are the common routines and these should be complied with as per the requirements of the terminal/port/state.
   4) When calculating cargo quantities, corrections for trim and heel should be allowed.
   5) Finally it is the responsibility of the Chief Officer to ensure that cargo measurements & sampling is carried out accurately. He should ensure correct tables are used for the right type of cargo. Care should be taken for obtaining the correct cargo density.

2. Cargo temperatures should be taken as follows:
   1) Cargo temperatures should be taken in all tanks loaded, as a rule, unless specifically instructed otherwise.
   2) Fixed thermometers should be checked for errors prior to use and such errors, if any, shall precisely be grasped.
   3) When there are 2 temperature detecting points in tank, the mean of each reading should be adopted. Average of the calculation should be used.
   4) If ship/shore difference of cargo figures of more than 0.3% is found and no reason can be attributed, a note of protest should be logged

3. Samples should be taken as follows:
   1) When a person concerned with the terminal takes samples, he should do so only after obtaining the permission of the Chief Officer.
   2) In principle, samples taken by the cargo surveyor should be kept on board. If this is not practicable, the Chief Officer shall take samples of cargo and keep them on board. The samples taken by the C/O should be signed by the shipper's representative & then to be sealed also.
3) Samples shall be taken from the sampling cock on the ship's manifold by the shippers at the commencement of loading and when the liquid level of tanks become one foot from bottom. When obtaining a sample of a refined product, a clean sampling device must be used.

4) Samples should be retained in the designated place on board. They should be labeled with the kind of cargo and date of sampling and care taken of to protect them from damage use specially designed sample locker to store the samples. The samples should be retained onboard for at least 2 years.

2.3.3 Discharging operation

Discharging operation shall be carried out in accordance with the "CARGO OPERATION MANUAL" prepared by the yard and approved by Class for the ship, taking into consideration the following items.

(1) Discharging plan

For making a discharging plan, the Chief Officer must check the hazards rating of cargoes with "HEALTH HAZARD DATA" described in the "USCG CHEMICAL DATA GUIDE FOR BULK SHIPMENT BY WATER" and the "MATERIAL SAFETY DATA SHEETS" and take into account the following factors to ensure the safety and efficiency of the operation and submit the plan to the Master for approval.

a. Discharging sequence, discharging time, and pipe lines and pumps to be used.

b. Checking the conditions of the vessel (changes in draft, trim and stress on the hull) in each stage of the discharging operation and make a ballasting plan.

c. Hull strength:
   The hull strength should be within permissible limits at any time during discharging operations and, if the vessel is to discharge at two or more ports, during navigation between such discharging ports.

d. Berth conditions:
   Berth type, condition of shore reception tanks, clear height, draft restrictions, reception of slops and ballast water, restrictions on pressure and flow rate, line flushing after the completion of cargo discharge, etc.

e. Discharging rate:
   Permissible capacity of the shore facility to receive cargo (including permissible rate for hoses or arms), capacity of the pumps of the vessel, discharging rate corresponding to the maximum flow rate in the cargo lines of the vessel, etc.

(2) Preparations before entering discharging port

A. Inspection and operational check of cargo equipment and instruments
   a. Pressure tests on discharging cargo lines for checking leaks:
A pressure test should be conducted by pumping cargo from a convenient tank and by applying about 150% of the working pressure with a pump on cargo lines to check for leaks from joints and valves of each line in particular and the results recorded. Defective parts, if any, must be repaired or other necessary remedial action be taken. After the pressure test, cargo contained in the pipe lines should be cleared into tanks in order to prevent damage to valves and lines due to expansion of cargo or clogging of lines due to solidification of cargo in the case of a heated cargo.

b. Leaks check for cargo pumps
Seal of each cargo pump shall be checked for leaks, and extent and kind of leaks, if any, shall be confirmed and recorded. Any leaking parts must be repaired.

c. Checks of gas leaks through openings on deck and vent system.
In calm weather conditions while at sea, gas leaks from openings such as tank cleaning holes, tank hatches, ullage holes and peep holes, must be checked; and leaks, if any, must be provided with necessary measures to rectify the situation, e.g., tightening the bolts and nuts and replacing gasket.

d. Operational test of tank level gauges:
An operational test should be made on the level gauges to check the matching of the readings shown locally and remotely in the CCR, the normal function of high/overfill and low level alarms should be checked and the results to be recorded.

(3) Discharging procedures
a. Meeting with shore responsible person prior to the commencement of cargo operation the Chief Officer must discuss the following matters with the shore responsible person on the basis of discharging plan:
   1) Information on safety, including the terminal safety regulations and the Ship/Shore safety checklist.
   2) Designation of smoking places
   3) Designation of access doors to the accommodation space
   4) Restrictions on the use of fire and cooking devices in the galley
   5) Items which require the posting of notices
   6) When operations which involve hot work or other repair work are conducted on board the vessel or in the shore facilities, as the place and method of such operations.
   7) Means and methods of communication between the vessel and the terminal.
   8) Emergency measures (emergency shut-down procedures)
   9) Discharging sequence, expected discharging quantity and the expected tanks to be discharged
   10) Discharging rate upon commencement of cargo work, maximum allowable discharging rate, manifold pressure and procedures to change over to a different kind of cargo and to finish discharging
   11) Method to check tanks which are to be dried up
12) Loading of ballast water, its quantity and required time; method of ballasting and restrictions on de-ballasting
13) Matters concerning the ship's facilities (e.g., the pump capacity, and the present state of tanks and pipes)
14) Matters concerning restrictions, e.g., on the height of the ship's manifold above the water (height of the bow fair-lead), draft and trim
15) Matters concerning shore facilities (movable scope of the cargo arm, connecting and disconnecting method, present state of pipes and tanks, special circumstances and requirements of the berth)
16) Matters concerning the procedures to measure the quantity of cargo, take samples, take temperatures and water cuts
17) Schedule and quantities of oil and water to be supplied
18) Additional matters which require confirmation concerning cargo work and safety
19) Legislation or voluntary requirements regarding mid sea water ballast exchange to avoid the discharge of harmful bacteria in territorial waters to be complied with. (!)

b. Cargo measurement, etc
Before the commencement of cargo discharge, the duty officer, under the direction of the Chief Officer, should measure the cargo quantity in the presence of the terminal responsible person or the cargo surveyor, take temperatures, and make an ullage report. He should calculate the cargo quantity of each tank by using the oil temperature and volume reduction of each tank and enter the results in the ullage report. The procedure should be in accordance with 2.3.1 (4) h. Tank openings, including ullage holes, should be opened only when they are used to take measurement and temperature, and closed immediately thereafter.

c. Procedures when commencing discharging operations

1. The Chief Officer must confirm before the commencement of cargo work that the cargo system (valve handling) is correctly lined up on the basis of the discharging plan. He must attend in person upon the commencement and completion of the discharging operation. The position (open or closed) of valves should be checked, and the cargo discharging system set up by observing the following:

1) The closure of all the valves (hydraulically driven or hand-operated) on the cargo lines, ranging from those operated at the console in the CCR, at local stands in the pump room and on the upper deck, to hand-operated valves, as a rule, should be checked. In the case of valves which have been kept open in consideration of thermal expansion inside the pipes to be used in the opened position, such valve positions should be confirmed. The above checking operation may be carried out for the purpose of improving
the efficiency of cargo work when sufficient time is available, e.g., at anchorage before berthing.

2) The cargo pipelines should be set for discharging on the basis of the discharging plan; the cargo pumps should be bled of air.

2. The Chief Officer must check in person the open or closed status positions of the valves and fitting conditions of blank flanges of unused manifold, and shall station crew members at specified locations in order to make the vessel ready to take action in response to the request of the shore to commence discharging.

3. After testing and confirming that the turning of the cargo pumps in good order, cargo discharge should be commenced at a minimum rate in the presence of the terminal responsible person. After confirming that no leak is observed or no excessive pressure applied on the whole cargo transfer system, including the pipe line and manifold, and that cargo transfer is being carried out properly both on board the vessel and ashore, the discharge rate must be increased gradually to its maximum permissible limit (flow speed or manifold pressure).

4. Upon the commencement of discharging operations, a person must be stationed to monitor the situation in the vicinity of the manifold, and it must be ensured that he checks and reports the outflow of cargo, manifold pressure and any cargo leaks from the connections so as to provide against emergency situations. At the same time, a person must be assigned in the pump room and another on deck monitoring the upper deck and the sea surface to take quick countermeasure against cargo spills. In case of the ships not having a cargo pump room, the operation to be monitored from the CCR and deck locally.

5. The mechanical seals and bearings of cargo pumps must be checked, upon the start of operation and changes in loads. Even if the vessel is equipped with remote indicators of temperature, they must be checked on site, as necessary. For pumps please follow the manufacturer’s instructions.

6. When cargo handling operations are commenced or resumed on board a vessel with trim, discharging must be carried out with differences in tank levels in mind to avoid overflows. When discharging is suspended temporarily, the suction valves for tanks which contain cargo must be securely closed to prevent overflows as a result of cargo being shifted from tank to tank.

7. Until the maximum cargo discharge rate is attained, all deck crew members must be engaged, under the direction of the Chief Officer, in checking leaks and monitoring unusual situation of the cargo transfer system.
d. Monitoring of ullage

1. During cargo handling operations, the ullage of all tanks must be monitored and the quantity of discharged cargo and the balance must be calculated to see whether the discharging operation is proceeding according to the discharging plan. Such figures must be recorded. Such check must be made at least once an hour. When the cargo oil in a tank has become small in quantity, the ullage should be monitored continuously.

2. On board a vessel where ullage is monitored with remote level indicator in the CCR, the readings of the indicator must be checked without fail to see that they show correct figures before crew members become constrained by time at the final stage of discharging cargo.

Vessels equipped with float type level gauges, should be checked to see that they properly function without sticking.

3. Special attention must be paid during cargo handling operations to the ullage of tanks in which cargo is not handled, to prevent unforeseen accidents caused by leaks of valves and pipe lines. It follows that ullaging devices for the tanks in which cargo is not handled may not be stopped until all operations are completed.

e. Heating

When heating of cargo is specifically requested by the consignee as a measure to improve the efficiency of cargo discharge and to prevent cargo outturn shortage, the cargo must be heated as instructed. However, if a request is made for heating in excess of the permissible temperature of the ship's facilities in view of, e.g., the set point of the high temperature trip for cargo pumps and the heat resistance of tank internal coatings and valves, such request must be rejected.

f. Stripping

In order to minimize transportation losses of cargo oil, the vessel should be trimmed by the stem as far as possible within a safe range and stripping shall be made completely.

g. Completion of cargo discharge

1. When the discharging operation is finished, the valves on the ship's side must be closed first after notifying the terminal to that effect.

2. After the finish of the discharging operation the disconnection of cargo hoses or arms must be carried out in the presence of the terminal responsible person and the Chief Officer or his substitute. Special care should be taken to prevent oil from spilling upon disconnection, e.g., by opening drain valves to drain off remaining cargo in the hoses or arms before disconnecting them.

3. After the finish of cargo discharge, the residual cargo in the deck pipelines (including small lines) should be drained into a tank after closing the manifold gate valves, thereafter such valves should be closed.
4. It should be ensured that tank openings such as ullage holes are closed.

h. Check of cargo tanks after cargo discharge
   After the finish of cargo discharge, the duty officer must check, under the direction of the Chief Officer, to see whether that cargo tanks have dried up, in the presence of the terminal responsible person or the cargo surveyor.
   Thereafter a signature of the terminal responsible person or the cargo surveyor should be obtained on a dry certificate. In some places this certificate is called the Empty Tank Certificate which is also acceptable as long as it is signed by the terminal representative or receivers appointed surveyors and etc.

2.3.4 Ship to ship transfer operation

When ship to ship transfer operation is carried out at sea, precautions listed below shall be observed in addition to the items described in the "Ship to Ship Transfer (Petroleum)" by ICS & OCIMF and above mentioned 2.3.1 and 2.3.2.

1. Main engine and auxiliary machineries shall be stand by for immediate use.
2. Adequate number of fenders shall be placed between both ships.
3. Cargo hoses connected to the ship's manifold shall be ready for quick disconnection in emergency case.
4. Mooring of both ships shall be arranged so that flammable and/or toxic vapor vented from the other ship shall not enter into the ship's accommodation space and engine room or shall not accumulate in dangerous concentrations around deck.
5. When handling cargoes which generate static electricity, cargo hose bonded in their inside shall be used, otherwise both hose flanges including intermediate one shall be bonded externally.
6. The ship commanding the operation shall be decided in advance.
7. Insurance group should be advised prior operation with all information that they need for insurance cover and the permission should be obtained.

2.3.5 Ship to barge transfer operation

For ship to barge transfer operation, the following precaution shall be observed in addition to those in above 3.3.

1. Operation shall be done only in favorable weather condition.
2. Persons engaging in operation shall be familiar with the nature and hazards of cargoes to be transferred and safety precaution to be observed mutually.
3. Mooring of ship and barge shall be done in such manner that ship and barge can be quickly released from each other in an emergency.
4. Operation shall immediately be suspended when unable to conform to safety standard of barge.
5. The barge shall be removed from alongside as soon as possible after completion of loading or discharging.
2.4 General precautions on cargo handling operation

2.4.1 Preparations before cargo handling

(1) Plugging in of the deck scuppers
   In order to prevent cargo spill the deck scuppers must be plugged in completely by putting expandable rubber scupper plugs. Rainwater accumulated on deck in rainy weather shall frequently be drained with permission from terminal responsible person after confirming no cargo liquids mixed.

(2) Spill tank
   The spill tank should be cleaned and dirt, rust, water and oil/cargo removed, and it should be ensured that all the valves and plugs are closed.

(3) Preparation of oil cargo spill response materials
   Before connecting hoses or arms; oil cargo spill response materials such as saw dust and rags, must be arranged in the vicinity of the manifold in order to respond oil/cargo spills.

(4) Manifold deck mat
   When hoses or arms are connected or disconnected, appropriate mats must be laid out on the deck in the vicinity of the manifold to prevent the generation of sparks by friction on deck by the accidental falling of the tools.

(5) Cargo manifold
   a. All the manifold flanges which are not connected with cargo hoses and arms should be closed completely with blank flanges fully bolted.
   b. It should be ensured that the drain valves and air cocks of the accessory lines connected to the main lines at the manifold are closed before the commencement of cargo handling operations.
   c. The manifold flanges which are to be connected should be cleaned of rust or dirt and new gaskets be provided.

(6) Preparation of fire-fighting facilities:
   These shall be prepared as per information provided in the Cargo Data Sheets.
   a. Before the commencement of cargo handling operations, at least two fire hoses fitted with multi-purpose nozzles and connected to fire hydrants should be arranged for immediate use each in ~the vicinity of the manifold and at the entrance to the pump room.
      Water should, as a rule, be introduced in the fire mains.
      When it is inappropriate to do so owing to the cold weather or other conditions (terminal regulations), the fire pump must be arranged for immediate operation.
   b. In the vicinity of the manifold, two portable fire extinguishers must be provided.
   c. The international shore connections should be provided for immediate use and its storage place should be clearly marked.
d. It must be borne in mind that for some chemicals water can not be used for the fire fighting so VSL’s fixed fire fighting means must be in readiness at all the times during cargo Loading/Discharging/Transfer/Tank Cleaning & Gas Freeing Operations.

(7) Fire wires
To provide for emergency situations while mooring, a fire wire with an eye at the end must be suspended through a chock on the offshore bow and quarter of the ship. The fire wires must be adjusted according to the change in the freeboard and trim so that the eye may be positioned about 1 meter above the water level at all times or as per the terminal requirements. The size of the wire should be as per OCIMF’s requirements.

(8) Derrick and crane
a. When a derrick or crane is to be used to lift up a hose, etc., at a single buoy mooring, it should be planned and prepared to ensure that it endures the load, by inspecting and providing maintenance service on the rotating parts and accessory equipment, including ropes and blocks to see that there is no unusual condition. Gears (cargo fall, etc.), in particular, should be removed of kinks and twists completely.

b. When operating a derrick or crane, the command system should be clearly understood by crew members who operate the winch. The orders and signals given by the signaler should be faithfully followed, and abrupt operations which may give shocks to the boom must be avoided.

c. The signaler must take care to ensure that no person is immediately below the derrick or crane or inside the bight formed by blocks and rollers.

(9) Deck lighting equipment and electric systems
Before arrival port, earth tests should be conducted and leaking points, if any, be serviced. Attention must be paid to the condition of glass cases for lighting and sheaths of cable leading to masts and posts, and damaged parts, if any, be repaired.

(10) All Chemical Tanker’s of more than 20,000 DD. WT. must be fitted with Emergency Towing Equipment as per SOLAS Requirements must be maintained in good condition at all the times.

(11) Cargo pumps trip arrangements: This emergency shutdown system must be tested every 15 days and must be recorded.

2.4.2 Safety measures during cargo handling operation

(1) Watch arrangement and monitoring around the vessel
During cargo handling operations, a sufficient number of crew members must be available on board to secure the smooth progress of the operations and their safety. The arrangement to keep cargo watches, including those upon the commencement of loading, commencement of handling water ballast and completion of cargo work, should be fixed in terms of the allocation of persons to
stations and the roaster arrangement, and entered in a watch arrangement schedule and posted in the CCR. The duty officer should post at least one crew member in the vicinity of the manifold to provide for emergency situations as well as to monitor the vessel and the surrounding area for oil/cargo spills from the vessel or drifting oil from other sources.

(2) Watch procedure and safety check at the terminal
   a. The duty officer and crew should constantly check the following matters.
   b. Cargo handling equipment is functioning properly and whether the operation is in progress at the specified capacity and according to plan.
   c. The vessel is properly moored and the accommodation ladder is in proper condition.
   d. Cargo is not leaking and the water around the vessel is clean.
   e. There is no unusual condition with the cargo levels in tanks which are not being loaded.
   f. No hydrocarbon or other toxic gases/vapours accumulate in dangerous concentrations around the vessel
   g. The emission of smoke from the funnel is normal.
   h. No vessels other than those authorized approach the vessel.
   i. No persons other than those authorized are on board the vessel.
   j. No hazardous work is conducted in places other than those authorized.
   k. The access doors and scuttles of the accommodation space are kept closed
   l. Proper lighting is provided at night.
   m. Necessary signals are displayed or lit.
   n. No hydrocarbon or other toxic gases/vapours are present in dangerous concentrations in the accommodation spaces and the machinery spaces.
   o. Necessary notices are properly posted.
   p. Warning boards at the gangway (e.g., "No open light", "No smoking", dangerous cargoes being handled, "No boarding without authorization"); cargo data sheet; designation of smoking places and other warnings to attract attention
   q. Weather and sea conditions are normal.
   r. The cargo hoses are properly connected and maintained
   s. The fire wires are properly suspended.
   t. The requirements of the terminal for draft, trim and other matters are complied with.

   When the terminal responsible person checks safety in accordance with the form specified by the terminal, the duty officer must render cooperation in the check. No cargo handling operation should be commenced before safety is confirmed.

(3) Connection of cargo hoses or arms
   a. The connection of cargo hoses or arms must be carried out in the presence of the Chief Officer or his substitute.
   b. The deck officer must inspect hoses or arms before connecting them to confirm that they are free from defects.
      The Master may refuse the use of a hose or arm which seems defective.
      The gaskets or 'O' rings at the connections must be clean and proper.
   c. Before lifting up cargo hoses by the ship's derrick/crane, it must be confirmed that the total weight of the hose and its accessories is within the safe working load of the derrick/crane.
d. Attention must be paid to the following matters upon the connection of cargo
   1) While lifting up a hose, no excessive bending or twisting should be given to the hose.
   2) The hose must be suspended within 3 meters horizontal and within 15 meters vertical intervals.
   3) The hose must be protected by providing materials to reduce friction at points where it comes in contact with metal parts, including the hull, wire or chain.
   4) It must be ensured that the hoses are safe against changes in the ship's trim, draft and the tidal level.
   5) The manifold flange should be compatible with the hose flange and they should be securely connected with bolts and nuts or devices attached to the hose.

e. Caution must be taken for following matters when connecting cargo arms:
   1) The vessel must be so positioned when moored so as to place her manifold in position, in relation to the cargo arms, in order to utilize the movable scope to its full advantage.
   2) It must be checked whether the manifold is able to support the load imposed by the weight of the arms and oil contained in them, and if there is a doubt as to its capability, proper saddles must be provided.
   3) When more than two arms are connected, they must not be crossed.
   4) The swivel joints of the arms should be checked for normal operation and no oil leak.
   5) The movable scope of the arm must be checked and the vessel must be controlled so that the manifold may be positioned within such movable scope by the adjustment of loading and ballasting operations, with consideration given to changes in trim, draft and tidal levels.

f. Special caution must be taken to prevent cargo spills when connecting or disconnecting cargo hoses or arms.

(4) Signals and lights displayed during cargo work:
When the vessel is not gas-free, she must display a red flag (international code flag "B") during daytime and a red light during night-time in Japan, if in an area subject to the "Maritime Traffic Safety Law", she must display a first substitute and a red flag ("B") in a vertical line instead of the above daytime procedure, and a statutory red flashing light during night-time.
In ports outside Japan, vessels usually must display a red flag ("B") during daytime and a red light during night-time, unless, other local regulations are required, such requirements must be met.

(5) Suspension of cargo handling operation
The cargo handling operation must be suspended in any of the following cases:
   (a) When the issue of a "Tsunami Warning" following an earthquake has come to the attention of the vessel.
   (b) When fire has broken out on or near the vessel.
   (c) When a violent thunder storm has come.
   (d) When another vessel has collided or is feared to collide with the vessel.
   (e) When the accumulation of hydrocarbon gas/vapours or other toxic gas vapours in a dangerous concentration is detected around the vessel.
(f) When other vessels (except small boats) come alongside or leave the vessel.

(g) When the vessel's mooring arrangement is threatened by deteriorating weather or sea conditions.

(h) When required by the terminal.

(i) When cargo/oil spill is found around the vessel.

(j) When a situation which is considered to create a source of fire and threaten safety, is found.

(k) Break away from jetty during cargo transfer.

In one of the cases among (a), (b), (g) and (j), the terminal must be requested to disconnect cargo hoses or arms in an emergency status.

(6) Measures to be taken in an emergency situation

(a) When, during a cargo handling operation, if one of the emergency situations listed in above (5) is likely to be or has been encountered, the duty officer must stop cargo work immediately, as well as notifying all parties concerned, including the terminal, and obtain approval.

(b) After the operation is stopped, all the valves of each pipe line system and at the manifold must be closed and the shore hoses or arms must be disconnected if necessary.

(c) In addition to taking the above-mentioned measure, all the crew must be informed of the situation and every effort must be made to prevent or eliminate dangerous situations.

(d) If necessary, the Master must put on security stations and shall order to put the engine on "stand-by".

(e) Against emergency situations which may be encountered during cargo handling operations, the Master must instruct the Chief Officer to educate and train his crew members according to the "Cargo Operation Manual" so that they may be able to take emergency measures, e.g., stopping cargo pumps, closing valves, and operating life-saving and fire-fighting equipment, and oil spill response equipment and materials.

(f) The Master must provide education and training for emergency action in response to cargo spills in accordance with the "Contingency Manual" and the "Education Training Books & Video" tapes.

Such education or training, when provided, should be recorded.

(g) In case of possibly of break away from jetty additional tug should be ordered & efforts made to secure ship with additional mooring lines.

(h) Notification of this incident should be made to all concerned parties.
2.5 Precautions for cargo control

2.5.1 Preservation of the quality of cargoes
In order to preserve the quality of cargoes, proper cargo control is required by maintaining secure segregation, heating, etc. on the basis of a clear understanding of their properties.
The following precautions should be taken to prevent mixture of different grades of cargo:
1) Special attention should be paid to the prevention of cargo contamination when the vessel is loaded with two or more different grades of cargoes and when they are shifted between cargo tanks at sea in order to adjust trim or heel, or an opening/closing test of valves is carried out.
(2) Attention should be drawn to cargo contamination, depending on the properties of cargoes, as a result of their vapours shifting via vent lines.
(3) Between different grades of cargoes with a large difference in Reid vapour pressure, a considerable amount of cargo may shift by the movement of vapours through the vent line.

2.5.2 Cargo heating
The temperature control should be exercised over cargoes liable to solidify with a high waxy content or viscous cargoes with a high pour point, at sea and during cargo discharge in response to their respective properties, in accordance with instructions by the charterer.
The following points should be borne in mind when heating cargo:
(1) Insufficient heating of cargo:
   Insufficient heating of cargo may not only cause delays in cargo discharge but also the impossibility of cargo discharge or a large amount of cargo being left behind. Once the cargo temperature drops below the solidifying point, waxy cargoes will solidify forming layers at tank sides and bottom, which requires heating for a long time in order to melt it, because of the lack of heat convection.
(2) Excessive heating of cargo:
   Excessive heating of cargo may cause deterioration in the quality by vapourization or separation of the lighter fractions of cargo, the waste of fuel oil, etc. and contribute to vapour locks or high temperature trips of cargo pumps during a cargo discharge operation.

2.5.3 Measures to prevent vapour loss
Cargoes of high vapour pressure containing a large amount of volatile content may partially vapourize at sea, resulting in vapour losses.
In order to minimize the amount of such loss, the following measures should be implemented.
1) Inspection and maintenance of breather valves:
   Breather valves should be regularly inspected and serviced and maintenance to be recorded.
   And the normal set pressure should be maintained at all times to prevent unnecessary release of vapours, maintenance of breather valves must be carried out as per the planned maintenance in the SMMS. (!)
2) Tank openings
In order to maintain air-tightness of tank openings, including access hatches, peep holes and tank cleaning holes, they should be inspected and serviced at regular intervals to prevent Leakage of vapours. Inspection/servicing must be carried out once a month during ballast passage or earlier if required and must be recorded.

3) Water spraying over the deck
When it is likely for the tank pressure to exceed the set pressure of the breather valve, water may be sprayed over the deck to cool down the upper deck and ship's side with sea water, thereby lowering the temperature and pressure of the ullage space.

2.5.4 Safety measures against cargo leaks

(1) Gas detection and sounding of adjoining compartments
during a laden voyage, soundings should be taken of the compartments adjoining cargo tanks, such as pump room, ballast tanks and cofferdams, and results shall be recorded every day.
Internal inspections should be made, as necessary, to find leaks at their early stage.

(2) Ullage of tanks
The level gauges should be put in operation at least once every day while at sea, and ullage should be measured to check for unusual conditions.

(3) Cargo leaks to cofferdam/other spaces
In the event, it has been noticed that cargo has leaked into cofferdam, ballast tank and other spaces. Ensure all safety precautions are taken as per the physical & chemical properties, fire hazard, toxic nature of cargo, reactivity etc.
Emergency measure to be taken:
1) to reduce/eliminate risk of fire explosion.
2) Control leak
3) Retransfer cargo back to tank.
Personnel involved in above operation should wear necessary protective clothing. Notification to the company should be made immediately &
advice sought. Care must be taken to ensure hydrostatic stability of the vessel is not affected.

Cargo release at sea & at terminal:
In the event this cargo has been leaked out at sea or at terminal, then Master must be guided in principle by the company’s contingency plan. If the physical properties of the cargo designated as toxic, immediate care & precaution must be taken to safeguard the health of personnel.
(1) Secure any inlets & reduce toxicity of the liquid.
(2) Make efforts to dilute and reduce toxicity of the liquid. Master should take suitable measures to minimize the effect of the cargo release.
(3) Notification of the incident to all concerned parties should be made.

2.5.5 SAFETY MEASURES WITH CARGO OF METHANOL

(1) While handling the cargo of Methanol the following precautions to be taken :-

a) Cargo tanks to be inerted / padded with N2 gas if fitted with N2 gas generator.
b) Terminal to be requested to connect the Vapour Return Line during all cargo loading operation, if available.
c) If cloudy and there is likelihood of Lightening during loading operation venting of vapours to be through Mast Riser or a single vent which can be shut quickly in case of lightening. Terminal to be requested for the same. Venting of vapours through individual PV vents to be avoided as they will take time to shut.

(2) During transportation of Methanol from one port to another, pressure from the tanks to be released regularly so that the PV vents do not lift during lightening. Release of vapour is not to be done during lightening.

Note: Manual Spraying of methanol is prohibited.
3.0 Inspection and maintenance of cargo handling equipment at sea

3.1 Cargo remote control system

The cargo remote control system should be inspected and serviced in accordance with the manufacturer's operation manual.

1) Electric system.
   Voltage, adjustment of contact points, grounding, testing of indicator lamps, operation of solenoid valves, etc.

2) Hydraulic system.
   Hydraulic pressure, hydraulic oil sump level, accumulator gas pressure, fouled hydraulic oil, contamination with water, sampling analysis, fouled strainer, activating pressure of the pressure relief valve, leak for the hydraulic pipe lines, pressure cycle, etc.

3) Air system.
   Air pressure, presence of leaking points, presence of drains, etc.

   In addition, if each equipment has alarm systems, their functions should be checked.

3.2 Maintenance of cargo valves

1) Paying attention to the operation of valves related to cargo operation systems and their leaks to prevent accidents, such as cargo contamination and overflows, the Chief Officer must provide maintenance service to keep them in good working condition. Before the commencement of cargo handling operations or at other occasions, he should conduct an operational test on valves, if necessary, to check for unusual conditions and record the results.

2) Hydraulically driven valves require special attention in terms of the operational speed in order to prevent a pressure surge. The manifold valves, in particular, should be adjusted so that the closing time may take about 30 seconds or more, if possible.

3.3 Maintenance of cargo pipe lines

Cargo pipe lines should be visually inspected or checked for leaks by applying positive or negative pressure on every occasion, e.g., tank inspection, available to grasp the present state.

The leaks should be repaired by a proper method and the details be reported to the Company.

The test pressure applied to pipelines should be 1.5 times the MAWP.
3.4 Cargo tank bulkheads

The tank bulkheads should be checked for leaks of any ballast and cargo whenever there is an opportunity to grasp its present condition.

3.5 Cargo pumps

(1) The emergency stop system of the cargo pump should properly function at any time to provide for emergency situations. When it is tested, the fact should be recorded in the "Safety Check List".

(2) The safety devices of the cargo pump with regard to over-pressure, over-speed and overheat should be regularly tested for normal function, and the results recorded.

(3) The relief valve of the stripping pump should be pressure-tested in drydock or on other necessary occasions to check the operational condition.

3.6 Cargo vent system

(1) The flame arrester fitted at the end of the vent line should be removed at least once every three months to keep it clean at all times. When inspection and maintenance service is provided, the fact should be recorded.

(2) The P/V valve of vent line, cargo tanks and the P/V breaker should be regularly inspected and maintained as per the maintenance schedule provided in the planned maintenance system (SMMS). Each P/V valve is to be numbered and a record to be kept of all maintenance for each valve maintained in SMMS.

The correct maintenance of these valves is essential to the safe operation of the vessel.

Each individual PV valves on the cargo tanks is to be inspected visually for condition of flame screens, any leaks and free movement.

Each P/V valve is to be dismantled, overhauled, flame screen on the vacuum side to be renewed and the PV valve tested on the test bench over a 6 month cycle. This is to be done on the ballast voyage with tank open to atmosphere and all supply valves to the tank shut. Maintenance is to be as required by maker’s instructions. On re-assembly, valve tightness is to be tested using soapy water.

Flame arrester gauzes fitted on the PV valves are to be checked prior to cargo operations to ensure that they are free from damages and polymerised substances which may prevent freedom of vapour flow.
3.7 Cargo heating pipe lines

The cargo heating pipe lines should be checked before cargo loading and serviced, if necessary and possible, to keep all heating pipes in good working order. When a pipe is repaired, the cargo heating pipe should be cleaned by blowing steam through until no oil cargo is discharged.

If the repair of a cargo heating pipe is beyond the scope of the crew hands' capability, the heating valve and drain valve of the pipe should be closed and kept out of use.

3.8 Lighting system and electric system for upper deck and pump room

The lighting system and electric wiring should be tested and checked for lamp failures and electric leaks regularly and before port entry, and bulbs replaced and electric leaks repaired, if defective parts are found.

Attention must be paid to the condition of glass case for lighting and sheaths of cabling leading to masts and posts, and damaged parts, if any, should be repaired.

3.9 Cargo samples storage & disposal

Cargo samples which have to be kept on board shall be stowed in a designated space situated in the cargo area or exceptionally, elsewhere subject to the approval of administration.

The stowage space shall be cell divided in order to avoid shifting of sample bottles out at sea and made of material fully resistant to the different liquids intended to be stowed and equipped with adequate ventilation arrangements. Samples which react with each other shall not be stowed close to each other.

Depending on the prevailing circumstances, the samples should be retained for at least a year, by which time notification of any claim should have been made. It is recommended that samples are retained for more than this period if there was clearly a problem or doubt concerning the product quality during the voyage. In most cases, cargoes will be loaded and delivered without incident and, in these cases, disposal of samples is a matter of common sense based on the availability of storage space. Ideally the head office should be asked to confirm that sample disposal is in order as it will have notification of any claim arising.
4.0 Handling of water ballast

4.1 Responsibility and Supervision

4.1.1 Responsibility of the Master
(1) The Master has entire responsibility for the operations provided in this chapter.
(2) Master should pay attention to comply with the Australian Ballast Water Guidelines as per consultation with our Marine Notice and in general should check and comply other status local regulations like rules of Canada, Israel, Chile, Peru, New Zealand, China and etc.

4.1.2 Responsibility of the Chief Officer
The Chief Officer has, under the direction of the Master, entire authority and responsibility for the handling of water ballast and delivers necessary orders to his subordinates verbally or in writing, thereby performing operations safely and efficiently in compliance with the Ballast water Management Plan and the relevant local regulations of the port states.

4.1.3 Taking on water ballast
For taking on ballast, the following restrictions, including the selection of tanks, should be observed.
(1) Cargo tanks may be ballasted in any of the following cases:
   (a) When it is inevitable to do so in adverse weather to secure the safety of the vessel.
   (b) When it is inevitable to do so to pass safely under a bridge or other obstructions.
   (c) When local port or canal regulations require specific draft to secure the safety of the vessel.
(2) Ballasting when restricted by specific terminal regulations of the port of call, special regulations, if any, of the terminal of the port of call in addition to (1) above, must be complied with.

4.1.4 Selection of tanks to fill with water ballast
The following matters should be considered when selecting tanks to fill with water ballast.
(1) Tanks to be filled with water ballast should be selected in such a manner that the safe navigation of the vessel is ensured and the restrictions in 4.2.1 complied with.
(2) For the purpose of carrying additional ballast in severe weather conditions, ballast tanks may be selected freely within the limit of restrictions on ballasting as provided for in 4.2.1.

4.1.5 Precautions for ballasting
When ballasting, special attention should be paid to the following matters:
1) When ballasting, the restrictions provided for in 4.2.1 and 4.2.2 should be always complied with. And every precaution should be taken, when filling dirty ballast tanks, in particular, to completely prevent the occurrence of pollution of the sea surface.

2) Even in the case of all water ballast being discharged to shore reception facilities, it should comply with the restrictions in 4.2.1 when ballasting.

3) When a cargo tank is filled with water ballast, the Chief Officer should enter necessary matters in the "Oil Record Book" on every such occasion.

4) Solidification

Solidification in the cargo tanks can occur when solidifying cargoes are stowed adjacent to “cold cargoes” or cold ballast water in adjacent spaces. Cargo tank bottoms must therefore always be checked for hard factions, at regular intervals throughout the voyage and always prior to arrival in the discharge port.

Due consideration has to be given to minimize the temperature reduction of the heated cargo while taking ballast in the adjacent tanks. Ballast intake to be planned accordingly in order to avoid solidification while carrying heated cargo.

Surface area exposed between the cargo and the ballast must be minimized. If possible, there should be no exposure of the ballast and cargo via the structure. This is to avoid any cooling effect which ballast water will have on the cargo which will cause solidifying of the cargo. Remaining ballast is to be only taken after the cargo has been fully discharged from the concerned cargo tank. When ballasting double bottom tanks or side tanks with double bottom, the level of the ballast should be below the deck head (cargo tank bottom) till the cargo is discharged.

In case of the following a) and b), filling with Ballast water in the concerned double bottom tank(s) must be controlled not fully filled, the quantity of Ballast should be adjusted to be less than about 70% of the ballast tank capacity.

a) Carrying the solidifying cargo onboard such as palm oil, beef tallow, fatty alcohol and phenol to avoid solidification.

b) Before loading the sensitive chemical cargo against moisture, in order to avoid sweat on the tank bottom.
4.2 Discharge of water ballast

4.2.1 Restrictions on de-ballasting

Discharge of water ballast should be done, in compliance with the following matters.

(1) Discharge of water ballast from segregated ballast tank. Water ballast in segregated ballast tanks should be discharged only after it is ensured that no oil/cargo is floating on the water surface.

(2) Discharge of water ballast from cargo tank. The discharge of clean or dirty water ballast from cargo tanks should be executed in accordance with the respective procedures as follows.

a. Discharge of clean ballast. The discharge of clean ballast should be made following the same procedure as that for de-ballasting from segregated ballast tanks mentioned above. It is mandatory to use the ODME when discharging ballast from the cargo tanks in compliance with MARPOL 73/78 for Annex I cargoes and for oil like substances.

b. Discharge of dirty ballast: In case the last cargo carried was as per Annex I of MARPOL 73/78. The discharge of dirty ballast should be made according to the following conditions unless it is transferred to a shore reception facility.

1) The tanker is proceeding en route.
2) The tanker is not within a special area (Mediterranean Sea, Baltic Sea, Black Sea, Gulfs, Red Sea, Gulf of Aden, Antarctic Ocean).
3) The tanker is more than 50 nautical miles from the nearest land.
4) The instantaneous rate of discharge of oil content does not exceed 30 liters per nautical mile.
5) The total quantity of oil discharged into the sea does not exceed 1/30,000 of the total quantity of the particular cargo of which the residue formed a part.
6) The tanker has in operation, an oil discharge monitoring and control system and a slop arrangement.

(3) Discharge of water ballast from slop tanks. When separated water is discharged for decanting from a slop tank; such discharge should be made from a position above the waterline without fail. In other cases, the discharge should be made in the same way as the discharge of dirty ballast mentioned above.
4.2.2 Deballasting when special regulations of the terminal of the port of call are in force

When de-ballasting is restricted by special regulations at the terminal of the port of call, such regulations, in addition to the restrictions provided in 4.3.1 (1) and (2), should be complied with.

(1) When water ballast is discharged, restrictions on de-ballasting provided in 4.3.1 should be observed. And when clean ballast or segregated ballast is discharged, in particular, special care should be taken to avoid unforeseen pollution of the sea surface and strict watch kept on the sea surface.

(2) Attention should be drawn to the fact that even when segregated ballast is discharged, oil/cargo may mix into ballast water through a hole on a ballast line running through a cargo tank or a bulkhead.

(3) The Chief Officer should enter the fact of de-ballasting from cargo tanks and decanting of the slop tank in the oil record book on every such occasion.

(4) Whenever discharge of cargo tanks cleaning water is to be carried out when the VSL is carrying chemicals then all the regulatory information provided in the beginning of this book section A must be complied with and all entries must be made in the Cargo Record Book.

4.3 Inspection and maintenance of equipment related to ballasting/de-ballasting

4.3.1 Inspection and maintenance

The following matters should be borne in mind for the inspection and maintenance of equipment related to ballasting/de-ballasting:

(1) Equipment also used for cargo handling
Almost all the ballasting/de-ballasting equipment is also used for cargo handling, and such common equipment should be provided with inspections and maintenance service in accordance with chapter 3 "Inspection and maintenance of cargo handling equipment at sea" with making necessary changes.

(2) Oil discharging monitoring and control system
The oil discharge monitoring and control system in the discharge of water ballast is a statutory device and should be inspected and maintained without fail. It should be operated in accordance with the "Oil discharge monitoring and control system operations manual". The oil discharge monitoring and control system should be approved for the use of oil like substances and various other chemicals that the ship is fit to carry in addition to Annex I cargoes of MARPOL 73/78.

(3) Oil/water interface detector
The oil/water interface detector, a statutory device, should be inspected and maintained for ready use at all times. it should be kept under the custody of the Chief Officer.
4.3.2 Action when the oil discharge monitoring and control system is out of order

When the oil discharge monitoring and control system has failed, the disposal of ballast and/or decanting operation is to be stopped immediately and office informed for appropriate follow up.

When the equipment has failed, the date of the occurrence, situation and date of reparation should be entered in the "Oil Record Book".
5.0 Tank cleaning and gas-freeing operation

5.1 General

Tank cleaning is essential on a chemical tanker, but it must be recognized as a potentially hazardous operation, and rigorous precautions should be observed throughout the process. Together with gas freeing, it is probably the most hazardous operation routinely undertaken on a chemical tanker. The additional risk created by cargo gases expelled from the tanks cannot be overemphasized. Depending on the most recent cargo carried in tanks that are to be cleaned, vapours that are toxic, flammable and corrosive should be expected to be released onto and around the cargo deck area. It is therefore of utmost importance that every possible care is exercised during all operations connected with tank cleaning and gas freeing, and that the operations are carried out using the approved procedures and arrangements for the ship.

Personnel involved should be fully aware of the dangers and take necessary precautions, because the consequences of an inadvertent error can be very serious and far reaching. Section 7.3 of the Tanker Safety Guide (Chemical) to be referred to and complied with for tank cleaning operations. The tank cleaning plans to be prepared and sent to office for review prior commencing the tank cleaning operations.

5.1.1 Requirements for carrying out tank cleaning operation

Tank cleaning should be carried out in the cases described below by the instructions of the charterer or the Company, or at the discretion of the Master.

1) When a grade of cargo different from the previous one is to be loaded and the cargo may be seriously affected if contaminated with the residue of the previous one, or edible oils are to be loaded after carrying toxic and hazardous cargoes, tank cleaning should be carried out.

2) When the tanks are to be gas-freed to check for condition of tank, inspect and/ or repair internal structure of tank at sea or on dry docking.

3) When it is inevitable to take in clean ballast in the tank.

5.1.2 Requirements for prohibiting tank cleaning

Tanks may not be cleaned with sea water in the following cases:

(1) During cargo handling operations.

(2) When work is being done inside a tank, the cleaning of tanks adjoining such tank should, in principle, be prohibited. However, the mucking operation (removal of sludge) before drydocking and emergency cases in which the Master considers tank cleaning inevitable, may be excluded provided that safety measures are taken.
(3) Cleaning of tanks adjoining a tank filled with cargo liquid should, in principle, be prohibited. This does not apply to cases when the Master considers tank cleaning necessary and inevitable.

(4) When another vessel is alongside the vessel, before drydocking, the case that a slop disposal ship or a barge is alongside the vessel for the purpose of receiving sludge, should be excluded.

(5) In other cases which the Master considers dangerous.

5.1.3 Suspension of tank cleaning operation

In the following cases, tank cleaning operations should be suspended:

(1) When the issue of a tsunami warning following an earthquake has come to the attention of the vessel.

(2) When fire has broken out on or near the vessel.

(3) When another vessel is approaching and involves a risk of collision with the vessel.

(4) When flammable or toxic vapours have accumulated unusually on deck.

(5) When there is thunder in the vicinity, threatening thunder bolts

(6) When it is difficult to carry out operations on deck safely owing to rough weather

(7) When it is difficult to drain tank cleaning water because of ship’s severe motion.

(8) When portable machines may come in contact with structures in the tank during tank cleaning operation due to ship’s rolling.

(9) When the oxygen content in the tank containing flammable vapours exceeds 8% during tank cleaning operations. When in an event of IG plant failure.

(10) In other cases, when the Master considers it dangerous.

(11) In cases where the VSL is not fitted with the IG system we recommend that the tank cleaning should be carried out in controlled atmosphere where necessary and the atmosphere of the tank should be frequently checked to ensure that the tank is being kept in the controlled atmosphere.

(12) All prewashing requirements for the chemical cargoes must be complied with as explained in the regulatory information of this book and should consult IBC or BCH Code as and when such cargoes are carried.
5.2 Responsibility and supervision

5.2.1 Responsibility of the Master

(1) The Master has entire responsibility for the operations provided for in this chapter.

(2) The actual operation of the tank cleaning to be carried out under the full charge of the Chief Officer after complete discussion Approval from the Master. The Chief Officer is to make a plan keeping all the safety aspect of the last cargo carried in the tank and the requirements for the next cargo to be loaded. This tank cleaning is very very important aspect of the operation of cargo work and must be carried out with absolutely safe atmosphere. In case of next cargo being Edible Oils the FOSFA list of banned cargoes should be consulted also the charterers full instructions should be strictly complied with.

(3) The Master should strictly control residues such as waste sludge etc. generated in the operations provided in this chapter to ensure that they may not be allowed to be thrown overboard, leak or fall off until after they are disposed off from the vessel in a lawful manner or they are discharged into shore disposal facilities.

5.2.2 Responsibility of the Chief Officer

(1) The Chief Officer must make a tank cleaning and gas-freeing plan in accordance with the "P & A Manual" prepared by the yard: approved by Class and provided on board and obtain the approval of the Master. When making a plan, he should give consideration to safety, efficiency and the adjustment of ship's condition in relation to retained ballast and slops in order to keep the hull stresses with in permissible limits and ensure proper draft and trim throughout all the stage of the operation. This manual should be consulted as necessary.

(2) Before the commencement of operations, the Chief Officer must make known, in writing or verbally on meetings, to his subordinates and other workers (workers of a contractor) such matters as the objectives and content of the operation, procedures of each operation and precautions to be taken.

(3) Before the commencement of the operation, the Chief Officer must check and ensure the proper functioning of detectors, protective outfits, safety equipment and other tools.

5.2.3 Responsibility of the duty officer

(1) The duty officer should be completely familiar with the ship's various equipment and pipeline systems related to tank cleaning and gas freeing operations.
He should supervise the operations following the instructions of the Chief Officer.

(3) The duty officer should make efforts towards safe and efficient tank cleaning operations, keeping close contact with the responsible person of the engine department.

5.3 Procedure for tank cleaning operation

Tank cleaning of chemical tankers shall be carried out in the following procedures including cleaning of cargo lines connected to.

5.3.1 Tank cleaning methods

(1) Washing by machines
Tanks shall be well washed by Butterworth machines in order to remove cargo residues as soon as possible after discharging.

(2) Washing by using tank cleaning chemicals (with warm or cold water)
Following washing by tank cleaning machines, tank cleaning chemicals, if necessary, shall be used according to kind of cargoes, to wash tanks clean. Cleaning chemicals to be used in tank cleaning.

1) Solvent of emulsifiers

They are solvent of aromatic hydrocarbons or aliphatic hydrocarbons. Generally, aromatized hydrocarbon has strong cleaning power but also strong smell, therefore adequate ventilation of tanks shall be necessary after cleaning. Aliphatic hydrocarbon shall act effectively to low-viscous cargoes as it has not smell but physically mixes with cargoes as emulsifiers. Concentrations of solvent are usually 2 to 6%.

2) Pure liquid of emulsifiers

They shall be diluted with water into concentrations of 0.1 to 0.05% and used with pressure of 7 to 10 kg per square meter after heated up to 60 to 80°C.

3) Alkaline detergents (Light Duty)

They are in powder or liquid and shall be used for diluting with water when light residues or deposits remain in tanks.

4) Alkaline detergents (Heavy Duty)

They shall be used to make non-drying fatty acids water-soluble. Difference between Light Duty and Heavy Duty is that Heavy Duty contains caustic soda and caustic kalium.
5) Neutral detergents:

They are composed of non-ion/anion surface active agent and glycolic ether etc., and shall be used for cleaning of tanks coated with zinc paints.

(3) Rinsing (with warm or cold water)

Immediately after cleaning operation is concluded, tanks shall be rinsed in order to wash away cleaning chemicals on the wall and bottom of tanks, using tank cleaning machines with warm or cold fresh water for about 2 hours.

(4) Flushing (with fresh water)

On final stage of cleaning operation, residues remaining on internal structures of tanks shall be mashed away using fresh water. Residues on the bottom of tanks and in the pipe lines shall, in particular, be completely removed.

(5) Steaming:

Steaming means introduction of saturated steam into the tank. The steam will condense on the tank surfaces. The use of steam in a tank is:

•To evaporate volatile residues (smell removal)
•To reduce the chloride

If it is intended to evaporate residues, it is mostly desired to raise the temperature as high as possible during steaming. This is enhanced, if the adjacent tanks (including ballast tanks) are empty.

If the freshwater has too high chloride levels, the use of steam for removal of chloride is often the only feasible option. Clearly the steam quality depends on the construction of the boiler. If the steam has acceptable low chloride levels, steaming is a good method to reduce chloride levels.

If the steam is used to remove chlorides, the wall temperatures should be cool in contrary to the evaporation method described above. This results in increased condensation and water film running down the tank walls to wash the chlorides off.

*Steaming shall be carried out, confirming no flammable vapour is present in tanks and all associated pipe line system after completion of cleaning and gas-freeing of tanks and pipe lines.*

*No steam to be injected to a tank adjacent to tanks containing heat sensitive cargoes.*

*Steaming of tanks with toluene or methanol is strictly prohibited on Wallem managed vessels.*
(6) **Draining:**
Tanks shall be mopped up by hand after completely pumping out by stripping pump or portable air pump.

(7) **Drying:**
Tanks shall be thoroughly ventilated and dried up using fixed or portable blowing machines.
During this operation, attention should be paid to prevent rain water or sea water from entering into tanks.

### 5.3.2 Preparation for tank cleaning

#### Pre-Cleaning conference

A pre-cleaning conference under the leadership of the responsible officer should be held prior to any tank cleaning or gas freeing operation. Other crew members involved should be identified by the responsible officer, and their role explained.

The conference should confirm:

- The tanks to be cleaned and the cleaning sequence.
- The type of cargo to be cleaned from each tank, and its characteristics. Cargo information sheets should be available so that personnel involved are familiar with the hazards.
- The major risks during cleaning such as toxicity, flammability, corrosiveness and reactivity.
- The safety equipment and personal protective equipment to be available and ready for use throughout the operation and during connecting and disconnecting of hoses at the cargo manifold.
- The cleaning instructions to be followed in each case.
- The means of disposal of any cargo residues and the contaminated cleaning water. The relevant slop tank must be specified in each case.
- The precautions necessary to confirm that the cargo deck area is free from cargo vapours during tank washing and gas freeing operations.
- That at regular intervals throughout the operation, checks will be made to ensure that tank washings containing cargo are not inadvertently being discharged into the sea.

#### Preparations

A written tank cleaning schedule should be drawn up and made available for reference by all personnel participating in the operations.

Before any tank cleaning or gas freeing operations begin, the responsible officer should confirm that all necessary equipment is available and that adequate checks are made to establish that all equipment to be used is in good working condition. Both before and during tank cleaning and gas freeing operation, the responsible officer should be notified that the appropriate precautions set out in
this chapter are being observed. All personnel on board should be notified that tank cleaning or gas freeing is about to begin, and only the personnel involved in the operations should be allowed into the cargo tank area.

If other craft are alongside the tanker, their personnel should be notified that tank cleaning operations are about to commence, and their compliance with all appropriate safety measures should be confirmed.

When gas freeing or tank cleaning while alongside at a terminal, the precautions for cargo handling in section 2.4 of this manual should be observed where appropriate. Before starting, the permission of the port authority and terminal operator should be obtained and the appropriate personnel ashore should be consulted to confirm that conditions on the jetty do not present a hazard, and to obtain agreement that operations can start.

The following checks should be made before operations commence:

- That essential protective clothing and respiratory protection equipment are being worn if so required.
- That fresh water shower and eyewash arrangements are ready for immediate use in the event of contamination of personnel.
- That work not related to cargo operations and not otherwise essential, is avoided in the cargo area during tank cleaning operations.
- That cargo pipelines serving a set of cargo tanks are isolated from the tanks to be cleaned or gas freed, unless all tanks in that set are to be cleaned.
- That tanks served by a common vent system are properly isolated.
- Those cargo tank lids, tank washing openings, ullage openings and sighting ports in uncleaned tanks are kept closed until they are to be cleaned.
- That all sea and overboard discharge valves connected to the cargo and ballast systems are shut and secured when not in use.
- That pumproom precautions are being observed and will continue to be observed throughout tank cleaning and gas freeing operations.
- That firefighting equipment is ready for immediate use.

5.3.3 Tank cleaning operation

General

Water is the most common washing medium for flushing the bottoms of cargo tanks, or for cleaning them using tank washing machines. It is readily available in large quantities, it is an efficient cleanser and on most chemical tankers the wash water can be heated when necessary. Nevertheless, it is sometimes necessary to use small quantities of chemical additives or detergents as a cleaning agent in order to improve the cleaning effect.

However, in some situations water will not be used. Water must not be used in the case of chemicals that react with water, and a washing medium other than water may also be used for commercial reasons. It may be permissible to use
ventilation to remove cargo residues and gas free a cargo tank after a highly volatile cargo has been carried. In every case, the full safety aspects of the operation should be considered.

When tank cleaning in port, relevant regulations and limitations established by the port authority and terminal to should be complied with.

After carrying a low flash point cargo, a flammable vapour mixture should always be suspected until tests have established that the atmosphere is non-flammable. Equal care is necessary after carrying a non-volatile flammable cargo at a temperature above its flash point, or after discharge of any cargo or ballast that had been loaded into a tank that was not free of flammable vapour. Toxic vapour in harmful concentrations should also be assumed after unloading cargoes which have a vapour inhalation hazard.

Cargo vapour, toxic or flammable, should be suspected in cofferdams or any other space within the cargo area into which such cargoes may have leaked.

(1) For tank cleaning operations, tank cleaning machines are usually used. Hand wash shall be made when necessary. For effective cleaning of the tank bottom, the tank should be drained thoroughly. During tank cleaning operations, precautions should be taken in relation to the following matters:
   (a) The cleaning machines are properly functioning.
   (b) The condition in which the tank is drained should be noted at all times. If necessary, tank cleaning should be suspended once and the tank drained until no residual water is left over, and then resumed.

(2) For tank cleaning with machines, precautions should be taken for the following matters:
   (a) Section 5.1 of this chapter should be used making necessary changes.
   (b) For fitting tank cleaning machines, tank pressure should be reduced sufficiently through the mast vent or PV valve before opening tank cleaning holes. Thereafter, tank cleaning holes should be opened.
   (c) Tank cleaning machines shall be safely secured to tank with rope to prevent them from swinging due to ship’s rolling.

5.3.3.1 Hazards when using re–circulated wash water, detergents

Recirculated wash water should not be used when the tank is being washed in an undefined atmosphere because it may increase the generation of static electricity.

Cleaning by recirculation may be dangerous if the dirty Oil/water mixture contains sufficient cargo of such a nature, that it will generate an electrostatic charge. Recirculation should not be practiced unless the tank is free of flammable vapor or is inerted.
It may also be hazardous if slops from cargoes which react dangerously together are being discharged into the same recirculation tank. The ISGOTT and USCG give guidance on reactivity, but care must be taken to avoid an unknown mixture in the slop tank. If possible, commingling of slops should be avoided. When using a coated tank as a recirculation tank, the effect of the slops upon the coatings must be taken into account.

Precautions: Before commencement of recirculation, the integrity of tank cleaning hoses and fittings must be checked under pressure with water only. After the system has been found tight, cleaning detergents may be added. The butter worth lid shall be covered with canvas to prevent cleaning water with detergent spraying on deck.

If tank cleaning chemicals are to be used it is important to recognize that certain products may introduce a toxicity or flammability hazard. Personnel should be made aware of the Threshold limit value (TLV) of the product. Detector tubes are particularly useful for detecting the presence of specific gases and vapours in tanks. Tank cleaning chemicals capable of producing a flammable atmosphere should only be used when the tank is inerted.

The selection of any detergents should be considered carefully taking into account any toxic vapours that may be released.

Some products may be used for the local cleaning of tank bulkheads and blind spots by hand wiping, provided the amount of tank cleaning chemical used is small and the personnel entering the tank observe enclosed space entry requirements. Risk assessment should be carried out for the local cleaning.

In addition to the above, any manufacturer’s instructions or recommendations for the use of these products should be observed. Where these operations take place in port, local authorities may impose additional requirements.

A material safety data sheet (MSDS) for tank cleaning chemicals should be on board the ship before they are used and the advice on any precautions to be taken should be followed.

5.3.4 Tank Washing Atmospheres

Tank washing may be carried out in one of the following atmospheres:

Inert - An atmosphere made incapable of burning by the introduction of inert gas, and thereby reducing the overall oxygen content. The oxygen content of an inert tank atmosphere should not exceed 8% by volume.

• Non-inert - An atmosphere which is undefined.

5.3.4.1 Precautions when tank washing in an inert atmosphere

Although the atmosphere in a properly inerted tank is incapable of burning, the following precautions should be observed:
• When portable washing machines are used, all hose connections should be made up before washing machine is introduced into the tank. Connections should not be broken until after the machine has been removed from the tank. However, to allow draining of a hose, a coupling may be partially opened and then re-tightened before machine is removed.

• The tank should be kept drained during washing. Washing should be stopped to clear any build-up of wash water.

When there is a need to maintain an inert atmosphere during tank washing, the following points should be observed:

• The purity and pressure of the inert gas being delivered during washing process should be monitored.

• Before each tank is washed, the oxygen level in the tank should be determined both at a point about 1 metre below the deck and at the middle level of the ullage space. At neither location should the oxygen level exceed 8% by volume.

• If during washing the oxygen level in the inert gas supply exceeds 8% by volume or the pressure of the atmosphere in the tank is no longer positive, washing should be stopped until satisfactory conditions are restored.

Some cargoes carried under an inert blanket are not flammable but the atmosphere is inerted for cargo quality reasons. In this case, if the inert atmosphere is not maintained then the procedures used and precautions taken should be as for an undefined atmosphere.

5.3.4.2 Precautions when tank washing in an undefined atmosphere

Most tank cleaning on chemical tankers is conducted in an undefined atmosphere. In all cases after after carrying a flammable cargo, the atmosphere in an empty tank should be treated as flammable. 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.

Good tanker practice will avoid all normal sources but, in addition, the following precautions should be taken if the risk from static electricity is to be eliminated:

• Before washing, the tank bottom should be flushed with water and stripped. The piping system, including cargo pumps, crossovers and discharge lines, should also be flushed with water. The flushing water should be drained to the tank designated to receive slops. This operation may not be necessary if the ship is fitted with an efficient stripping system, and the cargo tank and pipelines have been stripped as detailed in the ship’s Procedures and Arrangements Manual. (Note: If cargoes are highly water reactive this operation must not be carried out).

• When portable washing machines are used, all hose connections should be made up before the washing machine is introduced into the tank. Connections should not be broken until after the machine has been removed from the tank. However, to allow draining of a hose, a coupling may be partially opened and then re-tightened before the machine is removed.
• Ropes made of synthetic fibers should not be used to support the tank cleaning machines.
• No machine may have a throughput greater than 60 m³ per hour and no nozzle may have a throughput greater than 17.5 m³ per hour.
• The total water throughput per cargo tank should be kept as low as practicable and must in no case exceed 110 m³ per hour.
• The tank should be kept drained during washing. Washing should be stopped to clear any build-up of water.
• Re-circulated wash water should not be used, because it may increase the generation of static electricity (refer section 5.3.3.1 for details)
• Sounding rods and other equipment must be introduced through a sounding pipe reaching close to the bottom of tank and earthed to it. If a sounding pipe is not used then the additional precautions in paragraph 5.3.4.3 below should be followed.
• No other material that may create a spark or static electricity should be lowered into the tank.
• Steam should not be injected into the tank. Because of the hazard from static electricity, steam should not be introduced into cargo tanks 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.

5.3.4.3 Precautions for sounding tanks when not using a sounding pipe

If a sounding pipe is not used, it is essential that any metallic components of the sounding rod or other equipment are bonded and securely earthed until removal from the tank. This precaution should be observed during washing and for five hours afterwards, unless the tank is continuously mechanically ventilated after washing, in which case the delay period can be reduced to one hour.

During the delay period:

• An interface detector of metallic construction may be used if earthed to the ship by means of a clamp or bolted metallic lug.
• A metal rod may be used on the end of a metal tape which is earthed to the ship.
• A metal sounding rod suspended on a natural fiber rope should not be used even if the end at deck level is fastened to the ship, because the rope cannot be completely relied upon to act as an earthing path.
• Equipment made entirely of non-metallic materials may in general be used: e.g. a wooden sounding rod or float may be suspended on a rope without earthing.
• Neither ropes made of synthetic polymers nor should chains be used for lowering equipment into cargo tanks.

5.3.4.4 Cleaning of cofferdams or double bottom tanks

If it is necessary to clean cofferdams or double bottom tanks into which cargo liquids or vapour could have leaked, the same precautions should be observed as when cleaning cargo tanks.
5.3.4.5 Freefall of wash water in slop tanks

It is essential to avoid the free fall of slops or tank washing water in a receiving slop tank unless the tank is inerted. Washing water or slops should be transferred to the receiving tank through the cargo system. If a different arrangement is necessary, then to avoid splashing the receiving tank should be filled to a depth of at least 1 metre, or sufficient to ensure the discharge inlet is well below the surface of water.

5.3.4.6 Special Cleaning methods

Water washing may be inadequate or inappropriate after the carriage of certain products, because the tanks can only be adequately cleaned by special cleaning methods or cleaning agents.

Where it is decided to use special cleaning method, office guidance and approval to be obtained for the procedures ship will follow.

Where any special cleaning method is to be used in port, local authorities may impose additional safety or environmental requirements.

Some cargoes may react with certain cleaning agents and produce large amounts of toxic or flammable vapors, or render equipment such as pumps inoperable. The choice of a tank cleaning agent should be made with full knowledge of the cargo characteristics.

If a special method involving cleaning chemicals and additives is to be used, it may create an additional hazard for the crew. The ship staff to be made familiar with the hazards involved and the necessary precautions required. Proper PPE to be made available to all personnel involved in the cleaning operation.

The cleaning agents may be added to wash water or used alone. The cleaning procedures adopted should not entail the need for personnel to enter the tank.

If, however, the only practical means of cleaning involves personnel entering the tank, then the precautions mentioned in section 5.6 to be strictly followed. No one to enter the tank until all checks have been satisfactorily made as per the Enclosed Space Entry Permit contained in the Safety manual and the permission obtained from the Master (Authorised Person). Chemical absorption detectors to be used for detecting the presence of specified gases and vapors at specified TLV levels.

In exceptional circumstances the requirements might arise for wiping down product residues from the tank walls by using a chemical solvent in a localized area. The amount used should be small, and the personnel involved should be made aware that its use may modify the atmosphere. The introduction of the solvent into the tank might also generate additional risks such as toxicity or flammability. Such risks should be carefully evaluated before starting the operation, which should not be undertaken unless the personnel involved can be effectively protected from the risks. The data sheets for the chemical solvent used to be available onboard and referred to for the hazards and personnel protection measures.
A detailed risk assessment in company’s standard template to be carried out and sent to office for review prior carrying out the operation.

In addition, manufacturer’s instructions or recommendations for the use of commercial products should be observed, and the resulting slops disposed of in accordance with the ship’s P&A manual.

*The use of cleaning chemicals and additives, vessel to refer the latest MEPC.2/Circ.19/Annex 10 (CARGO TANK CLEANING ADDITIVES EVALUATED IN ACCORDANCE WITH MEPC.1/CIRC.590 AND FOUND TO MEET THE REQUIREMENTS OF REGULATION 13.5.2 OF ANNEX II OF MARPOL 73/78)*

5.3.5 Cleaning methods for each type of cargoes

Refer to the Tanker Safety Guide (Chemical) section 7.3 provided onboard for tank cleaning. Vessel also to be in compliance with any specific tank cleaning requirements as per the Charter party terms and conditions, if in any doubt clarify the cleaning requirements from the charterers and inform the Owners/managers/operators.

**Steaming of tanks with toluene or methanol is strictly prohibited on Wallem managed vessels.**

1. **Lubricating oils and additives:**
   Firstly tanks shall be cleaned with water using the fixed tank cleaning machines. Then as required, cleaning by detergents and steaming shall be done.

2. **Middle and high grade alcohols:**
   As high grade alcohols have high solidifying point, cleaning by warm water shall be necessary in winter season. After cleaning by chemical solvents or detergents and deodorizing by steaming, tank cleaning with fixed cleaning machines shall be made.

3. **Acrylic ethers:**
   Tank after discharged cargoes shall firstly be gas-freed as these cargoes have a peculiar smell. Then tanks shall be washed with cold water since these cargoes polymerize under the influence of light or heat. Further, tanks shall be washed with fixed cleaning machines after cleaning by detergents.

4. **Chlorides:**
   They are a kind of solvents having strong volatility and solvency but are insoluble in water. Where there is strict restriction to chlorine for next cargoes, it is necessary to carry out elaborate tank cleaning particularly. Regardless of organic or inorganic chlorides, mixture of chlorides is likely to cause adverse effect to catalysts in the plant and corrosion of the plant.
Tanks shall be gas-freed after discharge of cargoes and washed with fixed cleaning machines. Thereafter cleaning by detergents and steaming, if any, shall be done.

(5) Materials for resin:
Tanks after discharge of above mentioned cargoes shall be gas-freed as these cargoes are volatile and toxic.
Then tanks shall be washed with fixed cleaning machines and steaming, if any, shall be done.

(6) Phenols:
Tanks after discharging cresols and etc, shall be adequately washed by water and detergents/solvents, and steamed.
Then tanks shall be washed with fixed cleaning machines.
Nonyl phenol is extremely viscous and not soluble even in hot water, elaborate cleaning by detergents or solvents shall be particularly required.

(7) Animal, vegetable and fish oils and fats:
1) Drying oils (Linseed oil, Soya Bean oil, Sunflower oil, etc.)
Immediately after discharged cargoes, tanks shall be washed by warm water of about 30°C to 35°C in the following manner;
on upper and middle part of tanks about 30 minutes,
on lower and bottom part of tanks about 1 hour.
Then tanks shall be inspected for cleanliness.
When parts where cleaning is insufficient are found, such parts shall be cleaned intensively with portable cleaning machines using Light Duty alkaline detergents, then rinsing by sea water or fresh water shall be done. When unable to commence tank cleaning immediately after finish of discharging, Heavy Duty alkaline detergents shall be sprayed into tanks and opening of tanks shall be closed.
However these tanks shall not be kept closed over 24 hours.
2) Semi-drying oils (Corn oil, Cottonseed oil, Fish oil)
Cleaning shall be carried out in accordance with method for Drying oils but it is preferable to use softer detergents than those used for Drying oils.
3) Non-Drying oils (Coconut oil, Peanut oil, Cod Liver oil, Rapeseed oil, Palm oil, Olive oil, Whale oil, etc.)
Immediately after discharged cargoes, tanks shall be washed by hot water hotter than 80°C with pressure of 10 to 12 kg/cm² in the following manner; on upper and middle part of tanks about 1 hour, on middle and bottom part of tanks about 1.5 hours.
Thereafter cleaning by detergents or solvents shall be done. (Check the P & A manual for the acceptable temperature ranges with respect to tank coatings and valve seat rings – the maximum designed operating temperature the vessel is designed for shall never be exceeded)
(8) Molasses:
Immediately after discharge cargoes, tanks shall be washed by hot water hotter than 80°C with pressure of 10 to 12 kg/cm² in the following way;
    on upper and middle part of tanks about 1 hours,
    on lower and bottom part of tanks about 2 hours.
In alternative method, tanks shall be washed by cold water on upper, middle and lower part each for 30 minutes and again washed with warm 3% solution of Heavy Duty alkaline detergents on upper, middle and lower part of tanks each for 30 minutes.
Internal inspection of tanks shall be carried out after washing, when insufficient cleaning spots are found in tanks, such spots shall be sprayed with 20% solution of Heavy Duty alkaline detergents or non-diluted Light Duty alkaline detergents by portable cleaning machines and shall be left for about 1 hour.
Finally tanks shall be rinsed with sea water and then by fresh water. As far as hot water temperature and steaming of tanks the maximum allowable temperature as per coatings must be considered.
(Check the P & A manual for the acceptable temperature ranges with respect to tank coatings and valve seat rings – the maximum designed operating temperature the vessel is designed for shall never be exceeded)

(9) Monomers
As they are liable to polymerize under the influence of heat or light, tanks after gas-freeing shall be firstly washed with cold water then cleaning by detergents and steaming, if necessary, shall be carried out, thereafter tank cleaning with fixed cleaning machines shall be carried out.

5.4 Gas-freeing operation

5.4.1 Execution of gas-freeing operation

Gas freeing onboard chemical tankers is required for entry into cargo tanks, for hot works or washing for clean ballast tanks. Gas Freeing is one of the most hazardous operations routinely undertaken onboard a Chemical Tanker and the additional risk created by cargo gases expelled from the tanks, which may be toxic, flammable and corrosive, cannot be over-emphasised.

It is therefore extremely important that all care is exercised during gas freeing operations as the consequences of an inadvertent error can be serious and have far reaching consequences for personnel and the environment.

A space is considered as “gas free” when the concentration of flammable gases in its atmosphere is less than 0% LEL, the concentration of toxic gases (including IG components) is less than the TLV and the Oxygen concentration is not less than 20.8%.

Hazards may encounter at various stages. The following recommendations apply to cargo tank gas freeing in general. The IBC Code contains advice about cargo tank gas freeing.
It is essential to know what type of vapours can be expected: they may be flammable and/or toxic and/or corrosive:

a) Venting of toxic and flammable gas during gas freeing should be through the vessel's approved gas freeing outlets, and therefore the exit velocity should be sufficient to carry the vapours clear of the deck. No escape of cargo vapours should occur at deck level before the concentration within the tank has fallen below 30% LFL and the relevant TLV. Thereafter, final clearance of the vapour mixture may continue at tank deck level through other larger deck openings.

b) If portable ventilation equipment is to be used to blow air into a tank, tank openings should be kept closed until work on that tank is about to commence.

c) Where cargo tanks are gas freed by means of permanently installed fans, air is introduced into the cargo tank through the cargo lines. The entire line system should be thoroughly drained before venting to avoid any obstruction of the air flow or tendency for water or cargo residues to be blown into a cargo tank. Valves on the systems, other than those required for ventilation, should be closed and secured. The fans should normally be blanked or disconnected from the cargo tank system when not in use.

d) Fixed gas freeing equipment should not be used for gas freeing of a tank while simultaneously being used to ventilate another tank in which washing is in progress, regardless of the capacity of the equipment.

e) Portable fans should only be used if they are water driven, or hydraulically or pneumatically driven. Their construction materials should be such that no hazard of incendiary sparking arises if, for any reason, the impeller touches the inside of the casing. The manufacturer's recommendations for maintenance should be followed. Guards should be in place to prevent accidental contact with fan blades.

f) Portable fans, where used, should be placed in such positions and the ventilation openings so arranged that all parts of the tank being ventilated are effectively and equally gas freed. Fans should generally be as remote as possible from the ventilation outlets.

g) Portable fans should be so connected to the deck that an effective electrical bond exists between the fan and the deck.

h) The wind direction may cause cargo vapours to pass near to air intakes for accommodation spaces or engine room ventilation, and necessitate additional precautions. Central air conditioning or mechanical ventilation system intakes should be adjusted to prevent the entry of gas, if possible by using recirculation of air within the spaces.

i) If at any time it is suspected that gas is being drawn into the accommodation block, the central air conditioning and any mechanical ventilating systems should be stopped and the intakes covered or closed.
It is unlikely that any ship now uses window-type air conditioning units which draw in air from outside the superstructure, but any which are still in use, or other plants which are not certified as safe for use in the presence of flammable gas, should be electrically disconnected and any external vents or intakes closed.

j) If the tanks are connected by a common venting system, each tank should be isolated to prevent the transfer of gas to or from other tanks.

k) When a tank appears to have been gas freed and all mechanical ventilation has been stopped, a period of about ten minutes should elapse before taking final gas measurements. This allows relatively stable conditions to develop within the tank space. Tests should then be made at several levels and, where the tank is sub-divided by a wash bulkhead, in each compartment of the tank. In large compartments such tests should be made at widely separate positions. If satisfactory gas readings are not obtained, the tank should be checked for cargo residues and then ventilation resumed.

l) On completion of all gas freeing and tank washing, the gas venting system should be carefully checked, particular attention being paid to the efficient working of the P/V valves and any high velocity vent valves. If the valves or vent risers are fitted with devices designed to prevent the passage of flame, these should also be checked, and cleaned if found necessary. Gas vent risers and their drains should be checked to ensure that they are free of any blockage.

m) On completion of gas freeing, attention should be given to all equipment that has been used, and to enclosed or partially enclosed spaces that can retain or contain cargo residues or vapours, so that no unsuspected dangerous pockets can remain. Places where such cargo traces may exist include cargo lines, cargo valves, cargo pumps, stripping lines and valves, venting lines and P/V valves, vapour return lines, ullaging or sounding arrangements, heating coils, cargo handling equipment store rooms, protective clothing store rooms and cargo sample store rooms.

(1) The gas-freeing operation is carried out in the following cases:
   (a) When a special type of cargo is to be loaded and its properties may be changed by the admixture of the previous cargo gas, instructions are given by the charterer on each occasion.
   (b) When persons will enter the tank.
   (c) When drydocking.

(2) Gas-freeing operation must not be carried out in the following cases:
   (a) During cargo handling operations.
   (b) When another vessel is alongside the vessel. However, cases that a slop disposal ship or a barge is alongside the vessel for the purpose of receiving sludge before drydocking, should be excluded.
(c) When the local regulations or terminal regulations prohibit the execution.
(d) Other cases which the Master considers dangerous.

(3) The gas-freeing operation should be suspended in any of the following cases:
(a) When fire has broken out or on near the vessel.
(b) When another vessel is approaching and there is a risk of collision with the vessel.
(c) When there is thunder in the vicinity, threatening thunder bolts.
(d) When flammable/toxic gas has found its way into the living quarters and machinery spaces and it is impossible to prevent such entry.
(d) In other cases when the Master considers the continuation of the operation dangerous.

5.4.2 Procedures and precautions for gas-freeing operation

A space is considered as “gas free” when the concentration of flammable gases in its atmosphere is 0% LEL, the concentration of toxic gases (including IG components) is less than the TLV and the Oxygen concentration is not less than 20.8%. Comply with IBC/BCH code and ICS Chemical Tanker safety Guide requirement for gas freeing for chemical cargoes. (Ref IBC code CH.8)

The Chief Officer is to supervise gas-freeing operations. The gas freeing programme and the progress of operation must always be available to all concerned.

Protective clothing, resuscitation and firefighting equipment must be ready for immediate use. All doors, ports, windows are to be kept closed.

The inerted space can be purged with fresh air using the inert gas fans or water driven portable fans. Careful readings of the tank atmospheres must be taken with the ship’s portable gas detection equipment throughout gas freeing operations, a log of the readings must be maintained through the earlier stages of the operation, hydrocarbon readings are to be taken with the Tankscope (hydrocarbons by volume) and during the completion of gas freeing with the Explosimeter or Dragger Multigas Detector tubes.

Many vapours are heavier than air, and after they escape from the tank openings or vents they will tend to lie around the decks. With light wind (below 5 knots) flammable or toxic mixtures may not disperse and lie about at some distance from where they arise. These gases may be carried through openings into galleys, accommodation, deck lockers etc. or be drawn into machinery spaces.

It should always be suspected, even after spaces have been cleaned and made gas-free that some cargo liquid or vapour or both may be released whenever pumps, cargo lines, valves, heating coils, etc. are opened up. Precautions must be taken against such releases. Due to the risk of air pollution, gas freeing operations must not be carried out within port limits without the express permission of the appropriate authority.
When the ship is not provided with an inert gas system, the operation shall be such that the flammable vapour is discharged initially through:

- Outlets at least 2 m above the cargo tank deck level with a vertical efflux velocity of at least 30 m/s maintained during the gas-freeing operation; or
- Outlets at least 2 m above the cargo tank deck level with a vertical efflux velocity of at least 20 m/s and which are protected by suitable devices to prevent the passage of flame.
- The above outlets shall be located not less than 10 m, measured horizontally, from the nearest air intakes and openings to enclosed spaces containing a source of ignition and from deck machinery, which may include anchor windlass and chain locker openings, and equipment which may constitute an ignition hazard.
- When the flammable vapour concentration at the outlet has been reduced to 25% of the lower flammable limit, gas-freeing may be continued at cargo tank deck level. See SOLAS Ch 2-5 and IBC Code Ch 8 for more details.

Gas freeing precautions

1. Check what type of vapours is involved; they may be flammable, toxic, corrosive or a combination of the above.
2. Alert other non-essential crew including the engine room that gas freeing is to take place and that non-essential personnel should stay clear of deck areas.
3. Wind direction may cause vapours to enter accommodation spaces or engine room and necessitate proper precautions (i.e. at sea the vessel may have to be turned off the wind).
4. Portable ventilation equipment must be checked and fully operational
5. Personnel involved must wear personal protective equipment as necessary
6. Vapour must only be released through openings as stipulated in SOLAS and IBC/BCH code
7. After gas freeing no tank entry must take place before the Enclosed Space Entry Permit has been issued by the responsible officer and the tank has been “tagged” safe to enter.
8. All fixed and portable gas detection equipment must be in operation and suitably calibrated throughout the operations
9. Some vessels are provided with a fixed gas freeing system comprising a fan unit connecting to a pipeline on deck, which might be the cargo lines, the vapour return line or inert gas line. When gas freeing operations are completed, the fan must be completely isolated from the pipeline either by a
removable spool piece or a blanking arrangement. This is to ensure flammable or toxic vapours cannot reach the fan after the tank has been loaded.

Please be guided by the below mentioned guidelines while gas freeing of tanks that contain toxic and or flammable cargoes:

- A Responsible officer must supervise all gas freeing operations
- All personnel on board should be notified that gas freeing is about to begin
- Appropriate ‘NO Smoking’ regulations should be enforced
- Instruments to be used for gas measurement should be calibrated and tested in accordance with the manufacturer’s instructions before starting operations
- Sampling lines should in all respects be suitable for use with and impervious to the Gases present
- Only Portable fans or blowers which are approved for use in Gas Hazardous areas are to be used.
- Venting of toxic and flammable gas during gas freeing should be through the vessel's approved gas freeing outlets. No escape of cargo vapours should be allowed in the proximity of accommodation spaces and the velocity of venting should be sufficient to carry the vapours clear of the deck.
- If gas freeing is done through cargo pipelines, then the entire line system should be thoroughly drained before venting. Gas vent risers drains should be cleared of water, rust and sediment and any steam smothering connections tested and proved satisfactory
- When the gas level within the tank has fallen below 25% of the LFL and below 50% of the TLV of the known toxic gases, the other deck openings of the tank in question may be opened to complete the ventilation
- Intakes of central air conditioning or mechanical ventilating systems should be adjusted to prevent vacuum inside the accommodation. Window type air conditioning units which are not certified as safe for use in the presence of flammable gas, or which draw in air from outside the superstructure, must be electrically disconnected and any external vents or intakes closed. If at any time it is suspected that gas is being drawn into the accommodation, central air conditioning and mechanical ventilation systems should be stopped and the intakes covered or closed.
• Fixed gas freeing equipment may be used to gas free more than one tank simultaneously. However, gas freeing with fixed system must not be carried out while washing is in progress in another tank.

• If several tanks are connected by a common venting system each tank should be isolated to prevent the transfer of gas to or from other tanks

• If petroleum vapours persists on deck in high concentrations, gas freeing should be stopped

When a tank appears to have been completely gas freed, a period of about 30 minutes should elapse before taking final gas measurements. This allows relatively stable conditions to develop within the tank space. The testing of the atmosphere should be carried out to determine its flammability, as a percentage of LFL, and its toxicity relative to the TLV. Tests should be made at several levels. The venting must be stopped while carrying out atmosphere checks inside the tanks

5.4.3 Electrical Storms

During electrical storms in the immediate vicinity of the ship, all cargo operations, gas-freeing and tank cleaning that involve flammable cargoes must be stopped.

5.4.4 Effect of Wind

Most chemical vapours are heavier than air, so cargo vapours released during loading, gas freeing or accidental spills may concentrate in lower areas on deck, especially in conditions with little or no wind. Strong wind may create low pressure on the lee side of deckhouses or other structures, and thereby cause vapour to be carried in that direction. Personnel should be alert to either possibility. Due regard to be given on any possibility of wind following on vapour cloud. If necessary vessel’s course is to altered to ensure favourable wind direction while at sea or the cargo/ gas freeing operations to be ceased.

5.5 Gas testing

After finished gas-freeing, gas detection shall be done in accordance with "4.1 Measurement of oxygen content and gas detection" in the "Safety Manual" and the following items shall be taken into consideration.

5.5.1 Precautions for gas testing

For the measurement of the concentrating of flammable/toxic gases and oxygen, should be paid attentions to the following matters:
(1) The measurement by gas testing devices should be taken by the Chief Officer. If he cannot take measurements himself, another deck officer should do so but the Chief Officer should confirm the final measurements without fail. The gas measurement results should be entered in the "Oxygen Content/Flammable Gas, etc. Measurement Record" and reported to the Master.

(2) The gas testing should be conducted in such a manner as to take samples at upper, middle and lower levels from as many points as is possible. When the tank space is divided by a swash bulkhead, samples should be taken in each compartment. In a large compartment, samples should be taken at various locations throughout the range of the compartment.

(3) The measure should stand at the position where crew members can receive the wind from the left or right side to prevent inhalation of toxic gas.

(4) When work in a tank is intended, measurements should be taken locally on site, in addition to the measurements from the deck. When such local measurement is taken inside a tank, safety should be ensured beforehand by measuring the atmosphere in the vicinity from the deck, posting a guard on deck, and using a lifeline, as required.

(5) As the concentration of HC gas may rise with the increase in air or seawater temperature, consideration should be given to the interval at which gas testing is conducted.

5.5.2 Handling gas testing devices

The gas testing device should be inspected and maintained in accordance with the manufacturer's "Operation Manual" as well as Sections 8 & 9 of "Safety Manual" - to keep its proper functions, and used in a proper manner. When inspection or maintenance is provided, the result should be entered and recorded and also pasted on body of detectors.

(1) Before its use, the zero point adjustment should be made after sufficiently flushing the detector itself and the sampling hose by clean air.

(2) The span adjustment should be made by using a standard gas sample also the equipment should be calibrated before entering a compartment and otherwise every 3 months.

(3) It should be ensured that there is no leak from the sampling hose or defective connections.

(4) Care should be taken to keep the tip of the sampling hose away from water or oil on the bottom or other structures.
5.6 Entry into cargo tanks and other enclosed spaces

When entering enclosed space the procedures provided in the Safety manual section 7 and section 3 of Tanker Safety Guide (Chemical) to be complied with. The enclosed space entry permit (Safety manual – section 19.1.1) to be issued by the responsible person prior entering any enclosed space.

5.6.1 Entry into enclosed spaces being not ensured

Section 7.11 of the Safety Manual to be complied with when making an entry into an enclosed space which is not gas free.

*NOTE: Entry into a space that is not gas free or does not contain 21% oxygen will only be permitted following a risk assessment and approval from office such cases will be regarded as an emergency (Where safety of life is at stake)*

5.6.2 Work in Enclosed Space

While the personnel are inside the space, ventilation should be continued and atmosphere monitored at regular intervals. Frequent atmosphere tests as per the enclosed space entry permit contained in the Safety Manual to be made, appropriate to the work in hand or to any changes in conditions.

Working in a confined space requires a degree of good physical and mental health and is certainly not for the claustrophobic, those with heart or breathing problems or those with physical disabilities.

Identification and elimination of potential hazards at the tank cleaning planning stage will enhance the Health & Safety and Environmental performance of a tank cleaning project. A detailed risk assessment to be carried out for such work, all hazards associated with the job to be identified and control measures implemented to mitigate/minimize risks to acceptable level. (Company’s Standard Risk Assessment Template to be used).

Hazards relating to tank cleaning are as many and varied as the designs and physical dimensions of the tanks themselves.

Personnel entering a tank will be exposed to a number of physical hazards as follows:

- Climatic conditions
- Slippery Surfaces/Tripping/obstruction hazards,
- Hot cargo, hot surfaces & heating coils,
- Lack of Oxygen/ Toxicity
- Hazards imposed due to the location and physical design of the tank.
- Inadequate lighting/illumination
Hazards introduced by way of tank cleaning equipment, method of cleaning and personnel.

Climatic conditions can create unsafe conditions for those engaged in tank cleaning. Excessive internal temperatures are particularly difficult to manage and personnel must be allowed regular breaks for rest and for water and salt tablets to be consumed. Extreme cold and excessive noise can be equally debilitating.

Slippery Surfaces, Tripping hazards and other obstructions proliferate in storage tanks, it is essential that personnel be given a thorough understanding of the tank internal layout prior to entry. This problem is exacerbated due to generally poor lighting conditions which are often difficult to improve due to flammable atmospheres and/or the physical dimensions of the tank.

Falling objects, slippery surfaces, poor housekeeping, obstructions at head height in floating roof tanks, poorly maintained or inappropriate equipment etc. are other sources of danger which can be minimized by adequate risk assessment and training.

When performing manual cleaning, many hazards exist due to the location and design of the tank, and many more are introduced by way of tank cleaning equipment and personnel.

Precautions prior making the entry into the enclosed space for manual cleaning or sweeping the following to be complied with:

1. Risk assessment to be carried out in Company’s standard Risk assessment template provided in SBM II
2. Tool box meeting to be done with the personnel involved in cleaning sweeping operations.
3. Proper PPE to be provided to all personnel involved in the job. When selecting PPE, due regard to be given to adequately address the dangers of hot cargo, hot surfaces and heating coils, toxicity (CO, H2S and any other known gases) and slippery surfaces. MSDS of the cargo as well as the chemical agents being used for cleaning to be available onboard and referred to with respect to Safety and Health precautions.
4. Adequate illumination to be provided in the tank/space.
5. Adequate ventilation to be provided throughout.
6. The atmosphere top be monitored for Oxygen, HC and toxicity prior to the entry and at regular intervals as per Enclosed Space Entry Permit.
7. Enclosed Space Entry Permit to be issued by the responsible person prior to the entry.
8. The tools and cleaning gear used to be safe and suitable for the purpose and maintained in good condition. All equipment/cleaning gear to be inspected prior putting to use.
9. Due regard to be given to the prevailing climatic conditions (Hot/humid conditions, state of sea and swell, cold weather conditions). Appropriate measures to be in place to mitigate/minimize risks to acceptable levels.
10. A key element in minimising the risk is choosing an appropriate cleaning method. A number of semi and fully automated methods are commercially available.
11. Tank cleaning is an extremely hazardous activity with many difficult to quantify variables. As a general rule, time spent by personnel inside a tank should be kept to a minimum.

12. Training is the key to safe working in a confined space and personnel engaged in such activities should be carefully instructed and trained in all safety systems and procedures.

5.7 Tank cleaning and gas-freeing operations for drydocking

5.7.1 Objectives of the operations

In order to make entry into, or use of fire in, every location on board a vessel for the purpose of undergoing inspections and repairs safely in drydock, all places, including cargo tanks, pipelines, vent lines, pump room and cargo handling equipment, are required to be completely gas free.

5.7.2 Operation plan

When preparing and implementing an operation plan, the Chief Officer should refer to the section 5.1 to 5.6 of this chapter in conjunction with Wallem GmbH Safety Manual and give consideration to safety and prevention of marine pollution, keeping close liaison with other departments of the vessel and outside contractors.

5.8 Visual Inspections

Visual inspection can only be carried out when tank is gas free by entering the tanks. If the tank is to be entered particular attention has to be paid to the risks of lack of oxygen, toxic and/or explosive tank atmosphere. Always consider the tank ‘dangerous’ and act according to the Enclosed Space Entry procedures contained in safety manual section 7.

Condition reports of any visual inspections of cargo tanks prior to loading must be maintained on file for subsequent inspection by Third Parties.

Odour check

Some cargoes require being loaded in odour free conditions. It is important that tanks are cleaned accordingly and presented free of odour.

5.9 Wall Wash Test Procedures

Depending on the product to be loaded and the previous product, contamination tests will be carried out with indicators. There are usually tests as follows:

- Chlorides
- Hydrocarbons
- Inhibitor residues
- Lead compounds
- Permanganate time test (PTT)
• pH–tests
• Suspended matter

The results of all Wall Wash Tests are to be recorded and the Wall Wash Test Reports to be maintained in a file.

Wall wash Procedure

This describes an approved method for collecting and analysing wall wash samples to determine the presence of contaminants on the bulkheads. The procedure involves contacting a constant area of the bulkhead with a given amount of specification grade methanol, collecting the liquid and analysing it for the presence of chlorides, hydrocarbons, colour and particulate matter, or whatever might be required by the Charterer.

Precautions

a) Safety Considerations – eye protection is required when collecting the samples to prevent the inadvertent contact of methanol with the eyes during the sample collection process. Gloves should be worn to prevent the absorption of methanol into the skin.

b) Disposable plastic gloves are also worn to prevent contamination of the samples during the collection process. (A sufficient amount of chlorides can be absorbed from the skin to cause the sample to fail the chloride analysis).

c) Chlorides are abundant in the marine environment. All sampling equipment including bottles, funnels and other apparatus must be thoroughly rinsed with methanol (of less than 0.2 ppm chlorides content) and stored in plastic containers. Bottles are to be capped prior to sample collection.

d) Personnel collecting the samples must be certain that no perspiration or bare skin contacts the sample or sampling equipment while the wall washes are being collected.

e) Enclosed Space Entry Permit to be in place and compliance with enclosed space entry procedures contained in safety manual Chapter 7.

Choice of test sites

As a minimum, four sites of approximately 1.2 square feet each must be chosen in each tank. (If additional sites are chosen, 100mls of methanol should be applied to each location and collected in a separate container.)

Any area that appears to have crystalline deposits should definitely be tested.

Separate test of non-typical areas greater than 2 square feet (discolored patches etc.) should be conducted. The sample collected should be labelled with a description of the non-typical area. (These areas should be analysed separately.)
Sample collection procedures

Choose four surfaces to test.

1. Using the plastic wash bottle, squirt methanol on the test section at the highest practical point (normally 1.5 up to 2 metres) above the tank bottom in a stream of about 10cm wide.

2. Allow the methanol to run down the wall approximately 15 cm and begin collecting it with the funnel, squirting additional liquid as necessary to rinse the flushing into the sample funnel.

3. Continue this process until approximately an area of 10 by 120 cm has been rinsed with 100 mls of methanol.

4. After the washings from the four sites are collected, submit a portion of the sample for analysis of chlorides, colour, suspended matter and hydrocarbons, whatever is applicable. The accuracy of this test depends upon consistency.

5. Consistent number of sites tested.
6. Consistent area tested at each site.
7. Consistent amount of methanol applied to each site.
8. Consistent amount of methanol recovered from each site.

For the purpose of standardising methods and maintaining the desired consistency; the following criteria have been established:

Four wall wash sites.

i) An area of 10 by 120 cm for each wall wash.

ii) 100 mls of methanol applied to each site.

iii) 250 mls total minimum recovery of methanol (approximately 60% of each of the four 100 ml washings).

Equipment and Reagents:

1. Polyethylene washing bottles, 500 ml capacity
2. Bottles, glass with screw cap and polyethylene lined, of sufficient capacity to hold the washings.
3. Plastic disposable gloves.
4. Specification grade methanol (laboratory pure methanol) that has been tested to be less than 0.1ppm chloride by ion chromatography. (High quality methanol is vital to the accuracy of this test.)
5. Sample funnel, plastic or stainless steel with one flat side that can be held flush with the bulkheads.
5.10 Disposal of Tank Washings, Slops & Dirty ballast

During normal operations of a chemical carrier, the main need to dispose of chemical residues, slops or water contaminated with cargo will arise during or immediately after tank cleaning. Final disposal of slops or washwater should be in accordance with the ship's P&A Manual. Tank washings and slops may be retained on board in a slop tank, or discharged ashore or into barges.

5.10.1 Mandatory pre-wash water

Mandatory pre-wash procedures should be conducted strictly in accordance with the ship's P&A Manual, and the resulting contaminated wash water should always be discharged to shore. The intention of MARPOL is that this should happen immediately following the cargo discharge operations, and in the same port. However, occasions do arise when adequate shore reception facilities for the washings are not provided, and the ship must retain the washings on board until arrival at another port. MARPOL addresses this matter, and the P&A Manual will provide guidance on the correct procedures for a particular ship. During such a voyage, the slops and tank washings should be given the same safety and environmental care as the original cargo.

5.10.2 Dirty ballast

Dirty ballast, caused by ballasting into a cargo tank before the tank is cleaned, should be treated as slops, and must be disposed of in accordance with MARPOL and the ship's P&A Manual.

5.10.3 Safety precautions during discharge of cargo slops into the sea

When discharge overboard is permitted, it should only be undertaken when the ship is at sea normally be below the waterline through an underwater discharge outlet on the side of the ship away from essential water inlet valves. In the interests of safety, this procedure should be adopted even when it is not a mandatory requirement.

When any discharges are made above the waterline, care should be taken to avoid cargo vapour or liquid blowing back on board. If such a risk exists, discharge should be made below the waterline: if this is not possible, consideration should be given to altering the ship's course or speed to reduce the risk, and personnel on deck should wear appropriate protective clothing.

5.10.4 Management of slop tanks

Compatibility of various cargo and cleaning chemicals should be considered just as carefully when handling slops as when handling the cargoes themselves. Particular care is needed when washing several tanks which have contained dissimilar cargoes, and compatibility should be taken into account when selecting the destination tank for stripped wash water. The following should be avoided:

- Mixing of slops from Annex I (oil) cargoes with slops from Annex 11 (chemical) cargoes.
- Mixing of slops from incompatible cargoes.
- Mixing of slops from vegetable oils or fats with chemical slops or petroleum oil slops.
If the ship's cargo tanks are used as slop tanks, care should be taken to avoid introducing slops from cargoes which are incompatible with the tank coating. In this regard, some cargoes which are themselves compatible may, when mixed with water, form acids and thus damage a coating, e.g. slops from hydrolytic cargoes in a zinc coated tank.

Recommendations

Desloping of any kind of slops to a shore reception facility is a costly affair. Therefore it is highly recommended that in the event of any slops generation following pre agreement / written communication is made with charterers Operator.

- Advance notification with a clear and well planned operation for decanting of the slops.
- In case of insufficient time between the ports, a clear agreement on the extra time required for decanting.
- Prompt follow up in case vessel is unable to carry out decanting due to external reasons such as bad whether condition.
6.0 NITROGEN PURGING / PADDING & INERT GAS SYSTEM

It is the vessel’s Owner / Management responsibility to have procedures and checklist’s drafted to control the purging and padding of cargo tanks and enclosed spaces of the vessel.

Nitrogen is called the silent “killer” and the nature of Nitrogen to be known to all crew onboard the vessel. Procedure to be in place, for operations involving Nitrogen.

Please study additional warning signs and notification added to chapter 10.1.9 in this manual.

6.1 Reasons for purging / padding

The purging operation for volatile cargo is often carried out to avoid a flammable atmosphere during loading – and therefore – to avoid the static electricity requirements in order to increase the loading speed and to exclude the 30min waiting time after loading for vessels using a tape for ullaging without an installed sounding pipe. Normally the tanks will be purged down to an Oxygen content of less than 8%.

The purging operation for sensitive cargoes is carried out to avoid any damage to the cargo by moisture or oxygen. In these cases the tanks will be purged down to an Oxygen content of 1000ppm or even less (for some cargoes even down to less than 50ppm).

Purging

Several chemical cargoes carried are very sensitive and require pre-purging in order to avoid any damage to the cargoes e.g. PO, MDI, TDI, HMD, and other. The maximum Oxygen limit is very different e.g. max. 50 ppm to max. 1000ppm. The time used for purging is dependent from the Nitrogen supply from shore. If more than one tank is to be purged we recommend following the cascade purging system whenever possible.

Bubbling of Nitrogen into the cargo

For some cargos bubbling is used to increase the Nitrogen content in the cargo tanks. This is for example used during loading of P.O (Stade) and is done practically by inserting pure Nitrogen into the loading line and mixed it with the cargo.

6.2 GUIDANCE FOR VESSEL RECEIVING GASEOUS NITROGEN FROM SHORE

It is a frequent practice at chemical loading terminals to control the atmosphere in cargo tanks with nitrogen supplied from shore. The nitrogen can be for the purpose of drying a tank and its associated piping system, purging a tank before
loading the cargo, or padding cargo in a tank. Compressed nitrogen may also be used to propel a line scraper for clearing shore lines into the ship after loading, or for pressing small parcels of cargo out of their shore containers (often railway wagons) and into the ship. During both of these operations there is a possibility of an abrupt increase in loading rate from liquid at a few hundred cubic metres per hour to gas at several thousand cubic metres per hour. Agreement on the procedure for handling the nitrogen is paramount, and should be part of the pre-loading checklist between ship and shore, with emphasis on a clear understanding of the transfer rate and pressure.

Although the operation is an important stage in cargo handling, it is also potentially hazardous because high pressure gas is being introduced into a tank that is not designed to withstand internal pressure, and whose structure may fail at less than 0.5 bar overpressure. The associated risks of the operation should be thoroughly understood. Procedures should be in place to ensure safety during the operation, and all personnel involved should be made conversant with those procedures.

It is possible to overpressurise and even rupture a cargo tank if the nitrogen supply from shore is at too high a flow rate or too great a pressure. There have been incidents where structural damage has occurred.

When a liquid is being loaded through the cargo manifold and pipeline system on a chemical carrier, the existing atmosphere in the tank can escape through a vent system that is notably smaller than the liquid filling line, because friction and turbulence are far greater impediments to liquid flow than to gas flow. Ships are designed with this in mind. However, when a gas is being introduced through the liquid filling line, especially a gas under pressure that will expand within the tank, the same condition does not apply, and the disparate sizes between inlet and outlet can allow an overpressure to develop. To avoid such an eventuality the outlet for the existing atmosphere in the tank should be as big as or bigger than the pipeline supplying the gas. This is usually achieved by having the cargo tank lid or a tank washing hatch open.

But when vapour control and emission regulations require a closed operation (with the existing tank atmosphere forced to exhaust to shore), the incoming flow of nitrogen must be restricted to a rate equal to or less than the maximum flow of vapour possible through the venting system. If the capacity of the vapour return system is exceeded by the flow of nitrogen into a closed cargo tank, then the only other outlet is through the relief valve which will prevent overpressurisation (though contravening the vapour control regulations). However, if the capacity of both outlets is exceeded, then overpressure will occur and damage to the tank structure may follow.

The pressure or the flow rate of the incoming nitrogen must therefore be controlled. Use of a small hose or a reducer prior to the manifold will limit the flow rate, but pressure must be controlled by the shore.

The ship’s manifold valve is designed to control liquid flow. However, in an emergency the manifold valve can be used as a rapid safety stop; pressure surge
in a gas is not as violent as in a liquid and the nitrogen supply hoses are designed to sustain this pressure.

### 6.3 Quantity of Nitrogen Required

The anticipated quantity of nitrogen required for any particular purpose must be carefully evaluated, taking into consideration the following factors:

- The number of tanks that require maintenance of nitrogen blanket
- Duration of the voyage of which Nitrogen blanket has to be maintained.
- The production / storage capacity of nitrogen generator (if installed)
- Any interim ports in which stocking up may be possible
- The expected weather conditions during the voyage.

### 6.4 Drying or purging an empty tank that has been cleaned and gas freed

During the pre-transfer planning conference, the volume of nitrogen required should always be calculated and agreed (tank volume multiplied by number of volumes to reach the desired level of dryness or oxygen exclusion), and the flow rate agreed. Table 1 shows the volume of nitrogen that can be received in one minute through a known size of pipe at a known pressure. (The second figure in brackets indicates the associated hourly rate which should be mentally compared to a liquid loading rate. Note that these tables are intended to be indicative only, and any discrepancies are due to rounding of figures.)

<table>
<thead>
<tr>
<th></th>
<th>200mm (8&quot;)</th>
<th>150mm (6&quot;)</th>
<th>100mm (4&quot;)</th>
<th>50mm (2&quot;)</th>
<th>25 mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.2 bar (75 psi)</td>
<td>1771 (106000)</td>
<td>914 (55000)</td>
<td>343 (20600)</td>
<td>67 (4000)</td>
<td>12 (740)</td>
</tr>
<tr>
<td>3.4 bar (50 psi)</td>
<td>1286 (77000)</td>
<td>662 (39700)</td>
<td>243 (14600)</td>
<td>48 (2900)</td>
<td>9 (530)</td>
</tr>
<tr>
<td>2.1 bar (30 psi)</td>
<td>886 (53000)</td>
<td>171 (10300)</td>
<td>171 (10300)</td>
<td>33 (2000)</td>
<td>6 (360)</td>
</tr>
<tr>
<td>0.7 bar (10 psi)</td>
<td>471 (28300)</td>
<td>214 (12900)</td>
<td>80 (4800)</td>
<td>16 (1000)</td>
<td>3 (170)</td>
</tr>
</tbody>
</table>

**Table 1:** Cubic meters of gas at various gauge pressures

**Received in 1 minute (and 1 hour) through hoses at various sizes**

But if padding has to be performed after loading, planning and good communication are essential. The supply rate must not exceed the vent capacity of the cargo tank. The vapour space in a loaded tank is usually small, so over pressurisation can occur very suddenly, especially if cargo is forced into the vent lines which then become restricted or blocked and add to the rapid increase in tank pressure.

A safe practice is to introduce the nitrogen directly into the ullage space via a small diameter connection at the top of the tank (PV mast) or into the ship’s cargo
line, preferably using ships equipment and gas supply at a low pressure, but if necessary from shore through a small diameter connection to restrict the flow. Introducing it from shore through the manifold valve and the tank filling line after clearing the shore loading line presents a higher risk and gives very little time to react correctly.

Pressure gauges and sensors should be closely monitored during the operation, and the ship’s officer should be in direct supervision throughout. The operation should be stopped when a slight overpressure exists in the ullage space, but before reaching the tank pressure relief valve setting.

Using nitrogen to press a product out of shore tanks into the ship, or for clearing a shore line into the ship after loading:

These operations may also be undertaken using other compressed gas, usually air, but the process and the inherent risk of over pressurisation are the same. The gas pressure used for these an operation varies, but can range between 2.5 and 5 bar. During a line clearing operation it is important that terminal staff react promptly when the scraper is caught in its trap, in order to avoid all the compressed propelling gas entering a loaded cargo tank. The point of greatest concern is when the supply into the ships tank changes from liquid to compressed gas, and the tank filling rate increases dramatically. It will be seen from Table 1 that a significant volume of gas will be received in a few seconds through the large liquid filling line. Over pressurisation of a closed tank can occur in seconds, especially when the distance from the manifold to the tank is small or the vapour space in the tank is limited.

Discharge of cargo:

When discharging cargoes that have to be carried under a blanket of nitrogen it may be necessary to ensure that no air is drawn into the tank. Therefore an overpressure of nitrogen should be maintained as the liquid level falls, using stored compressed gas or from a nitrogen generator on board, and be introduced into the tank ullage space.

If it is necessary to obtain nitrogen from the shore, it is essential that the pre-transfer discussion includes agreement on the nitrogen flow rate and pressure to be used. Although the overpressure required is no more than about 0.2 bar, it is usual for the shore nitrogen supply system to be well above this figure, perhaps as high as 7 bar. Particularly in the early stages when the ullage space is still small, it is possible for the flow rate to exceed the tank venting capacity, and for an overpressure to develop. A safe procedure is to use a pressure reducing device on the nitrogen supply pipeline, and to have a calibrated gauge showing the pressure in the pipeline. There should be constant communication with the terminal, and the ship should monitor cargo tank ullage space pressure throughout.

Ship and shore should agree in writing on the inert gas supply, specifying the volume required and the flow rate in cubic meters per minute. The sequence of operating valves before beginning the operation and after completion should be agreed, so that the ship remains in control of the flow. Attention should be given
to the adequacy of open vents on a tank to avoid the possibility of over pressurization. The tank pressure should be closely monitored throughout the operation.

The ships agreement should be sought when the terminal wishes to use compressed nitrogen or air as a propellant, either for a line scraper to clear shore pipelines into the ship or to press cargo out of shore containment. The ship should be informed of the pressure to be used and the possibility of receiving gas into the cargo tank.

6.5 PADDING OF LOADED TANKS (as guideline only)

After the tank has been loaded, it might be necessary to add additional nitrogen to create an effective nitrogen blanket on the cargo. Like the purging operation, also padding of tanks may create a risk for tank rupture and cargo overflow.

The vessel must therefore be in control of the entire padding operation and the duty officer should personally supervise the operation of the manifold valve and must control the start as well as the flow of nitrogen. It should be borne in mind that throttling of conventional vessel manifold valves is a relatively ineffective way of controlling the flow or restricting the gas volume. The tank pressure is to be closely monitored.

To control the pressure into a loaded cargo tank and especially in situation where the tank is filled up to 95/98%, the use of only stripping line open for filling of Nitrogen, is an easy and safe way of controlling the flow into the tank. This method can be used on all Submerged Cargo Pumps.
Onboard Nitrogen generator safety check (For vessels fitted with Nitrogen generator)

It is expected that the N2 generator onboard is kept in working condition at all times. Normally generators fitted on board vessels have both 99.9% and 95% mode. It can be used for padding highly reactive chemical cargos as well as a substitute for a conventional inert gas system for loading and discharging any Annex I cargoes.

Calibration of some analyzers could be complicated therefore it is imperative that concerned staff should fully familiarize themselves upon joining the vessel as mentioned in the working manual. Regular operation of the system will detect any malfunctioning at an early stage so that we have sufficient time to rectify the problem.

To keep the system in the state of readiness it should be tried out every month without fail in both 99.9% and 95% mode.

Following checks to be carried out regularly as given in the operating manual
• The oxygen analyzer should be calibrated regularly to ensure that it gives the correct reading. The sample line should be clean and free of moisture accumulation.

• The trying out should not be limited to only running the system. The nitrogen produced should be delivered to deck. This can be done by opening any flange on the Nitrogen branch line on deck. This will ensure smooth operation of the pneumatically operated deck valves as well as pressure control valve and main supply valve in engine room. This practice will minimize the chances of the valves getting seized due to long period of in operation and will also put the entire electronic control system into test.

• Manual operation of the valves should be looked into so that the valves can be operated manually if required.

• Concerned staff should read the manual and do the relevant maintenance as required related to the compressors, filters and auto drain valves.

Following is maintenance guidance which can be carried out for nitrogen generator.

• Refer to your onboard maker’s manual for ships specific routine maintenance.
• Check alarm oil level, drain valve, belt, oil leakage during operation of compressor.
• Change oil of compressor as per running hour or once every year. Check operation of drain valve overhaul as required.
• Check filter differential is maintained within acceptable limit, when exceeding 0.07Mpa change element.
• Calibrate oxygen analyzer before every operation. Pass instrument air to check alarm during operation.
• Check operation alarms once every 3 months by simulating the alarm condition. Take out heater out of shell once every year. Replace charcoal bed once every 5 years.

6.6 INERT GAS SYSTEM

6.6.1 GENERAL

Hydrocarbon gas cannot be ignited in an atmosphere containing less than about 12% oxygen by volume. Cargo spaces which are kept inerted to 8% oxygen or less are thus protected from fire and explosion.

The Company places the highest degree of importance on the continuous availability of inert gas and on its correct use. Cargo spaces and slop tanks are to be kept in a properly inerted condition at all times except when required to be gas free for entry, or for dry-dock.

No transfer of oil cargoes or slops and no tank cleaning operations are permitted unless the I.G. system is working.
On product tankers where the Charterers have explicitly instructed vessel not to inert cargo tanks and provided the Terminal permits this condition, only then is cargo transfer permitted without using inert gas. The non-use of inert gas and supporting documentation is to be readily available.

Reference to be made to ISGOTT Section 7.1

6.6.2 RESPONSIBILITY

The Master has overall responsibility for the safe and proper operation of the I.G. system and will ensure that both Deck and Engine Departments carry out their respective functions correctly.

The Chief Engineer is responsible for the operation and maintenance of the I.G. plant and the Chief Officer is responsible for the deployment of the inert gas and control of cargo tank atmospheres and pressures including the setting of all valves on deck. Close co-operation is essential.

6.6.3 SYSTEM MANUAL

The I.G. System Manual for the individual ship should be consulted for details of operational and maintenance procedures

6.6.4 INERTING BEFORE LOADING

Prior to arrival at an oil loading port all empty tanks are to be inerted and a check is to be made with a portable oxygen analyser to ensure that they do not contain more than 8% oxygen by volume. It is to be noted that some terminals may limit to 5% oxygen by volume.

Mast Riser cowl wire mesh should be inspected, and cleaned if necessary, preferably each voyage.

6.6.5 LOADING

During loading the I.G. plant will be shut down and the deck main isolating valve closed. The I.G. pressure recorder is to be kept on to record any abnormal pressure surges whilst loading.
6.6.6  **ON PASSAGE**

It is important to maintain a slight positive pressure in the ullage spaces of cargo tanks to avoid the ingress of air through the P/V valves. It may be necessary to operate the I.G. plant periodically for short periods to maintain this condition. The I.G Pressure should be logged in the Deck log at the end of each watch.

6.6.7  **DISCHARGE**

The I.G. plant must be started prior to the commencement of discharge and OPERATED CONTINUOUSLY THROUGHOUT. The main blower has a capacity at least 25% in excess of the total pumping capacity to enable a positive pressure to be maintained in the tanks.

Both the Oxygen content and pressure of the inert gas to be continuously recorded during discharge.

A separate risk assessment is to be done and office informed if vessel requires to ballast any cargo tank in port. Officer is also to be informed if shore requires the shore line to be flushed with sea water delivered by ship’s cargo pump.

6.6.8  **TANK CLEANING**

Prior to the commencement of tank cleaning with water the atmosphere in each tank to be washed must first be checked with a portable oxygen analyser and the oxygen content established as being 8% by volume or less throughout. Testing should be conducted at three levels in each tank and, where possible, from more than one sampling point.

INERT GAS MUST BE SUPPLIED TO THE TANKS THROUGHOUT WASHING.

6.6.9  **GAS FREEING**

If any tanks are required to be gas freed they must first be purged with inert gas to reduce the hydrocarbon gas content to a maximum of 2% by volume as determined by a properly calibrated Tankscope.

The purpose is to reduce the hydrocarbon gas content to below the CRITICAL DILUTION LINE so that subsequent introductions of air will not result in a flammable mixture developing (Please refer to section 13.12 in the safety manual).

Tanks being gas freed must be isolated from the rest of the I.G. system.

6.6.10  **INERT GAS SAFETY CONTROLS**
The I.G. Control Panel provides constant information regarding system pressures together with high and low pressure alarms. It must not be switched off at any time when the ship has petroleum cargo or slops on board.

The deck water seal is the ultimate safety barrier between the cargo system and the engine room and it is essential that the water is kept at the correct level at all times.

### 6.6.11 SAFETY CHECKS WHEN PLANT IS SHUT DOWN

Whenever the I.G. plant is shut down, ie. during loading, on passage, etc. the Vent valve located between the deck water seal and the I.G. blowers must be open. The normal level of the deck seal must be prominently marked.

Following safety check should be done at sea when plant is not operational.

1. The water supply and water level in the deck seal should be ascertained at regular intervals, at least once per day depending on weather conditions.
2. In cold weather, ensure that the arrangement to prevent the freezing of sealing water in the deck seal, pressure / vacuum breaker etc. are in order.
3. Before the pressure in the inerted cargo tanks drops to 100mm they should be re-pressurized with inert gas.

### 6.6.12 SYSTEM TEST SCHEDULE

The testing Programme to be carried out prior arrival at discharge port and is to include the following functions:

1. All alarms and trips.
2. The functioning of the Flue gas Isolating valves
3. The operation of all remote or automatically controlled valves.
4. The function test of deck water seal and non-return valve.
5. The vibration level of IGS blowers.
6. Gas leakages in the System before and after the deck seal.
7. The interlocking of soot blowers.
8. Check for any gas leak from tanks(Butterworth covers, ullage ports etc).
9. Operation of PV Valve
10. Calibration and operation of Fixed oxygen analyzer**
11. ** VIQ requires the Fixed oxygen analyzer to be calibrated immediately prior to the use of the inert gas system and vessels to comply with this requirement.

### 6.6.13 MAINTENANCE PROGRAM
Please follow manufacturer’s guidelines. The Maintenance program is to be part of the maintenance system on board (SMMS).

6.6.14. EXCHANGE OF TANK ATMOSPHERE.

There are three principal arrangements.

<table>
<thead>
<tr>
<th>Arrangement</th>
<th>Inlet point</th>
<th>Outlet Point</th>
<th>Principle</th>
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<tbody>
<tr>
<td>1</td>
<td>Top</td>
<td>Top</td>
<td>Dilution</td>
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<tr>
<td>2</td>
<td>Bottom</td>
<td>Top</td>
<td>Dilution</td>
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<tr>
<td>3</td>
<td>Top</td>
<td>Bottom</td>
<td>Displacement or Dilution</td>
</tr>
</tbody>
</table>

The main difference between dilution and displacement is that in dilution method the velocity of the incoming gas should be high while in displacement the velocity of the incoming gas is low. The velocity of the incoming gas should be as low as around 250 mm WG in the displacement method. This is also the more efficient of the two methods.

In the displacement method it is important that the bellmouth is free of a liquid, which will create a seal and obstruct the passage of IG. Therefore, the tanks have to be well stripped.

When inerting cargo tanks from fresh air, it is important, the oxygen content must be below 8% at all levels

6.6.15 COMPOSITION AND QUALITY OF INERT GAS

International Convention for the Safety of Life at Sea requires that inert gas systems be capable of delivering inert gas with an oxygen content in the inert gas main of not more than 5% by volume at any required rate of flow; and of maintaining a positive pressure in the cargo tanks at all times with an atmosphere having an oxygen content of not more than 8% by volume except when it is necessary for the tank to be gas free.

In certain ports the maximum oxygen content of inert gas in the cargo tanks may be set at 5% to meet particular safety requirements, such as the operation of a vapour emission control system. When such a limitation is in place, the ship should discuss these requirements in the pre-arrival information exchange.

Efficient scrubbing of the inert gas is essential, particularly for the reduction of the sulphur dioxide content. High levels of sulphur dioxide increase the acidic characteristic of the inert gas, which is harmful for personnel and may cause accelerated corrosion to the structure of the ship.

6.6.16 INERT GAS SYSTEM FAILURE

Solas requires that each ship fitted with an inert gas system be provided with detailed instruction manuals covering operations, safety and maintenance requirements and the occupational health hazards relevant to the installed system and its application to the cargo tank system. The manual must include
guidance on procedures to be followed in the event of a fault or failure of the inert gas system

6.6.17 ACTION TO BE TAKEN ON FAILURE OF THE INERT GAS SYSTEM

In the event that the inert gas system fails to deliver the required quality and quantity of inert gas, or to maintain a positive pressure in the cargo tanks and slop tanks, action must be taken immediately to prevent any air being drawn into the tanks. All cargo and or ballast discharge from inerted tanks must be stopped. The inert gas isolating valve closed, the vent valve between it and the gas pressure regulating valve (if provided) opened, and immediate action taken to repair the inert gas system.

Masters are reminded that national and local regulations may require the failure of an inert gas system to be reported to the harbour authority, terminal operator and to the port and flag state administrations.

In the event that the inert gas system is unable to meet operational requirements of this regulation and it has been assessed that it is impracticable to effect a repair, then cargo discharge, de-ballasting and necessary tank cleaning shall only be resumed when the emergency conditions laid down in the ‘IMO Guidelines on Inert Gas Systems’ are complied with. In brief, these guidelines state that;

1) In the case of tankers engaged in the carriage of crude oil, it is essential that the tanks be maintained in the inerted condition to avoid the danger of pyrophoric iron sulphide ignition. If it is assessed that the tanks cannot be maintained in an inerted condition before the inert gas system can be repaired, an external supply of inert gas should be connected to the system to avoid air being drawn into the cargo tanks.

2) In the case of the carriage of products, if it is considered totally impracticable to effect repair of the inert gas system, cargo discharge may only be resumed if an external supply of inert gas is connected, or the following precautions are taken:

   a) That approved devices, or flame screens, to prevent the passage of flame into cargo tanks are fitted and checked to ensure that they are in good order;
   b) The valves on the mast risers are opened;
   c) No free fall of water or slops is permitted; and
   d) No dipping, ullaging, sampling or other equipment should be introduced into the tank until a period of five hours since injection of inert gas ceased. If essential for the safety of the operation, this should be done only after 30 minutes have elapsed and all metal components should be securely earthed. (IMO Inert Gas Systems 8.3)
7.0 Safety Onboard

7.1 GENERAL

It is imperative to avoid contact with any chemical substance or product carried onboard. All necessary care and attention shall be paid in order to prevent skin and eye contact. Precaution shall be made to avoid inhalation of toxic vapours and/or swallowing of toxic products.

It is the owners responsibility to have procedure for all cargo operation issued and implemented onboard the vessel. This manual from Seatrans Chemical Tankers is meant as a guideline and supplement to your own procedures.

7.2 PROTECTIVE CLOTHING

Depending on the specific cargo to be handled (loaded, discharged, sampled, cleaned etc.) or any cargo related activity, protective clothing must be used.

Hazardous products requiring the use of Protective Clothing will be regularly handled onboard. These activities shall be properly planned by the Master or Chief Officer and all crew members involved shall be briefed on the potential hazards and instructed with respect to the Protective Clothing requirements.

THE TYPE AND DEGREE OF PROTECTION REQUIRED WILL BE DEPENDENT ON THE PREDOMINANT PHYSICAL, CHEMICAL OR TOXIC PROPERTIES OF THE PRODUCTS HANDLED.

PROCEDURE REGARDING PROTECTIVE CLOTHING TO BE INPLACE AND IMPLEMENTED ONBOARD YOUR VESSEL (Also refer chapter 9 of the tanker safety guide – chemical for details)

7.3 MATERIAL SAFETY DATA SHEETS (MSDS)

In all incidents involving chemicals or oil products the first requirement is for rapid access to accurate information concerning the product involved and the actual and potential hazards posed by the product when contained or accidentally released.

Material Safety Data Sheets are in widespread use throughout the industry and whilst the information contained within MSDS is specially prepared to provide guidance to the user of the product, the document usually contains sufficient information to respond effectively to an incident.
Information must be available on board the ship for each particular cargo, and prior to loading. The information should include:

- A full description of the physical and chemical properties, including reactivity, necessary for the safe containment of the cargo
- Compatibility with other materials
- Action to be taken in the event of spills or leaks
- Countermeasures against accidental personal contact
- Fire fighting procedures and fire extinguishing media
- Procedures for cargo transfer, tank cleaning, gas freeing, and ballasting
- Whether the chemical is stabilized
- MSDS to be studied and discussed during pre-loading meeting. MSDS must always be present and available for all crew onboard.

### 7.4 EXPOSURE TO CHEMICAL

Exposure to chemical or petrochemical products through inhalation, ingestion or skin exposure can lead to poisoning; many products have a combination of these hazards. However inhalation is the main route of entry for most substances into the body.

Exposure to such substances by any route should either be prevented or where this is not reasonable practicable, adequately controlled through procedure implemented onboard.

Exposure to vapours may occur during routine operations or incidents involving spills.

Since ship personnel may work for years in operations involving exposure to various vapours it is of vital importance that the health hazards are taken seriously and are not underestimated.

The ships personnel must be made aware of the chemicals or petroleum products being handled together with the hazards associated with each of them.

This shall be done by posting the proposed stowage plan together with the Material Safety Data Sheets covering all products handled in a clearly identified place.

### 7.5 VAPOUR INHALATION

Inhalation of vapour or mist contaminated air is the most likely route by which harmful substances enter the body.

The effect of exposure depends upon:
- The toxicity of the vapour
- The level of contamination
- The volatility of the product at the loading or discharging temperature

Exposure of the body to the vapour may cause a wide variety of effects, such as:

- Systemic poisoning
- Irritation of the noise
- Throat and respiratory system,
- Suffocation/asphyxiation

Suffocation may be caused by exposure to a vapour or gas which otherwise has little harmful effect. However, if it is present in a sufficiently high concentration, such that the oxygen content of the mixture in the air is below the level for human survival, suffocation/asphyxiation will occur.

The effects of a person who is inhaling a poisonous gas (or being anaesthetized) will depend upon the concentration and exposure. Broadly the following will be the pattern for medium to low concentration above the Threshold Value.

a. The sensations are blunted, the skin becomes numb and movements are clumsy.

b. An excitable and emotional phase usually follows as the higher centres become inhibited and primitive emotions are set free.

c. As the vital centres become affected, a state resembling sleep follows which becomes deeper and deeper as more gas is inhaled. At first the breathing is normal but becomes weaker as the "anaesthetic effect" of the poisonous gas takes over the vital centres.

d. Finally, the vital centres become paralysed, breathing eventually ceases and death soon follows.

If the concentration of vapour is particularly toxic, as in the case of a number of chemical products the above effects will take place very rapidly, to the extent that total unconsciousness may follow one inhalation.

If the brain cells are deprived of oxygen for more than four minutes they will die, it will be remembered that the cells in the higher centres will become affected first.

Some toxic vapours act by preventing the cells from using oxygen. In such cases, recovery will occur when the poison effects "wear off" provided the body can be kept supplied with oxygen. This is particularly the case with Hydrogen Sulphide (H2S) poisoning.

The hazards associated with vapour inhalation may therefore be summarised:

- Lack of oxygen in the air breathed
- Toxic effects of the vapour breathed poisoning the brain cells and/or depriving the cells of oxygen.
The need to get oxygen to the brain cells becomes vital if a victim is to be saved. The time factor of four minutes has been adopted for the period between a person seen to be overcome by gas and the arrival of the Emergency Party.

7.6 SKIN CONTACT

Many liquids and certain vapours can be absorbed through the skin. When absorbed they may be distributed by the bloodstream and have the same effect as if swallowed or inhaled. The danger of absorption is increased if the skin is broken by cuts and abrasions. In these circumstances, the hazard may be increased resulting in even a slightly toxic substance having harmful or even severe effects.

Protective Clothing and goggles must be worn by personnel under circumstances that he/she is likely to come into contact with corrosive products or products that may be absorbed through the skin.

Normal fabrics and footwear give no protecting from this hazard and personnel must wear suitable protective clothing, boots, gloves and goggles. Any contaminated personal clothing must be removed immediately, and kept out of the Accommodation.

Personnel are to pay particular attention to skin contact hazards when:

a. Sounding of tanks and Samples, stripping and blowing of cargo line
b. Connecting and Disconnecting Hoses
c. Opening tank lids or releasing pressure from PV-Valve’s
d. When in the vicinity of the Manifold
e. When entering Tanks, tank cleaning
f. When investigating leakages
g. When dealing with and incident at the Manifold or elsewhere on deck involving a spillage.

In the event of contact with any of these hazardous products the immediate action is to THOROUGHLY WASH THE AFFECTED AREA WITH WATER. Under no circumstances should a solvent be used.

Personal hygiene is particularly important and all personnel involved in cargo operations must wash (shower) thoroughly especially before eating.

7.7 FILTER MASK

Use of Filter Mask for all cargo operation, onboard vessel operated by Wallem Ship management is not allowed. Several serious accident onboard vessels where filter mask was involved are reported from the shipping industry. Additional BA Sets should be available to compensate for filter mask.
7.8 NITROGEN HAZARD

Everyone should understand that one deep breath of 100% N2 will be fatal. 100% N2 will displace CO2 and O2 completely. And, in the absence of a CO2 signal to the brain, the stimulus to breathe no longer exists! You will stop breathing!!

Personnel should be aware of the potential hazards associated with Nitrogen and, in particular, those related to entering enclosed spaces or area in way of tank vents or outlets which may be oxygen depleted. High concentrations of Nitrogen are particularly dangerous because they can displace enough air to reduce oxygen levels to a point where people entering the area can lose consciousness due to asphyxiation. A problem not experienced with flue gas is that Nitrogen cannot be detected by human senses, so smell cannot be relied upon and personnel may not be able to recognise the physical or mental symptoms of overexposure in time for them to take preventive measures.

Nitrogen is an odourless, tasteless, and invisible gas that can cause asphyxiation by displacing oxygen. It is especially dangerous because the exposed person cannot detect that the oxygen level of the air they are breathing is too low. Only one or two breaths in an oxygen-deficient atmosphere can have very serious immediate effects, including loss of consciousness."

It is not necessary for nitrogen to displace all of the 21% of oxygen normally found in air to become harmful to people. Exposure to atmospheres containing 8-10 percent or less oxygen will cause unconsciousness without warning so quickly that individuals cannot help or protect themselves. Exposure to an atmosphere containing 6-8 percent oxygen can be fatal in as little as 6 minutes. Exposure to an atmosphere containing 4-6 percent oxygen can cause a coma in 40 seconds and subsequent death.

Recommended actions:

Proper hazard assessment should lead the crew to specify hazard controls when a nitrogen purge is in progress. Controls and procedure to control the risk, must be implemented for all purging operation onboard your vessel. Procedure for enclosed space purged with Nitrogen must be in-place and implemented

First-Aid measures

- Call for help and remove victims to fresh air as quickly as possible. BUT: make sure, YOU are protected!
- Obtain help from trained personnel immediately.
- If not breathing, trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation (CPR), if necessary.
7.9 MEDICAL EMERGENCIES

The vessel must always be prepared for emergency situations related to any cargo operation. Use of safety equipment and proper training for all crew involved is a must. The MSDS of the cargoes carried to be available on board. The staff to be trained and familiarized with the countermeasures against accidental contact with personal. The proper PPE to be made available to all personnel.

*In case of a Medical Emergency, assistance to be obtained from the vessel’s Medical Advisory Service provider. The details are contained in MCCM manual appendix 7.*

*Reference to be made to IMDG Code Supplements, Medical First Aid Guide for use in accidents involving dangerous goods, Emergency Response Procedures for ships carrying dangerous cargoes (EMS Guide) MFAG for use and EMS.*
8.0 Emergency Procedures

8.1 Loss of stability

If loss of stability becomes evident or is suspected at any time during loading or discharging, the following steps are to be taken. It should be noted that every vessel is different and the different plans or critical checklists are to be adopted for each vessel.

This is particularly crucial in doublehull ships without centre line bulkheads but nonetheless, is required for all vessels.

1. Immediately stop cargo and all other operations such as ballast and bunkers. Activate emergency shutdown of cargo operations.

2. Advise terminal operator;

3. Advise office who will declare a contingency

4. Ensure all mooring ropes are tight;

5. Carefully check levels in all and verify number of slack tanks (ballast, cargo and bunker);

6. Determine the cause (e.g. incorrect or deviation from loading/discharging plan or technical cause such as valves or other cause of cargo/ballast internal transfer);

7. Enter data into loading computer in order to check GM; and check for angle of loll and investigate preventive action accordingly.

8. The company is to be kept fully advised on the situation. The majority of tankers have contracts with vessel’s emergency response service provider (e.g. LR SERs, RRDA etc) and assistance from them will be sought in most cases. They will require accurate data on the vessel’s tank status in order to perform these calculations.

9. Create a draft plan for correcting the situation. No action is to be taken without permission from the company who will be obtaining advice from the damage stability provider. The only exception to this is when the master considers it essential to for the purpose of saving the vessel and he considers immediate action is required.

10. When loss of stability has occurred, on no account is any ballast or cargo to be pumped out. Where ballasting is required only split double bottom tanks are to be filled, starting with the side which the vessel is listed over to, before making the ship upright with double bottom tanks on the opposite side. On no account are DB tanks that run the full width of the
ship to be ballasted as this could increase free-surface with disastrous results.

11. Before attempting to correct the stability, the plan must be carefully checked using the ship’s loading computer in order to check the criteria at every stage of the plan. The plan is to be agreed with the terminal operator before commencing the operation and hoses disconnected.

12. Once stability is correctly restored, further checks should be made in order to ensure that adequate stability is maintained for the remainder of the cargo operation.

**Required documents:**

- Ship’s “Trim and Stability Data/Manual” (Approved by Class)
- Ship’s “Procedures and Arrangements Manual” (Approved by Class)

### 8.2 Overstressing due to high density cargoes

If overstressing due to high density of cargo is becomes evident or is suspected at any time during loading or discharging, the following steps are be taken. It should be noted that every vessel is different and the different plans or critical checklists are to be adopted for each vessel.

1. Immediately stop cargo and all other operations such as ballast and bunkers.
2. Advise terminal operator;
3. Advise office who will declare a contingency
4. Ensure all mooring ropes are tight;
5. Carefully check levels in all cargo oil tanks, ballast tanks, bunker tanks, FW tanks & Lub Oil tanks.
6. Determine the cause (e.g. incorrect or deviation from loading/discharging plan or technical cause such as valves or other cause of cargo/ballast internal transfer);
7. Ensure the data entered in the loading computer is accurate in order to determine the actual stress and stability condition, and send the loadicator print out or duly filled up ERS form to the office and the emergency response service provider (e.g. LR SERS, RRDA)
8. The company is to be kept fully advised on the situation. The majority of tankers have contracts with damage stability providers (e.g. LR SERS) and assistance from them will be sought in most cases. They will require
accurate data on the vessels tank status and weight distribution in order to perform these calculations.

9. Create a draft plan for correcting the situation. No action is to be taken without permission from the company who will be obtaining advice from the vessel’s Emergency Response Service provider (e.g. LR ERS, RRDA etc), particularly if structural damage has taken place due to overstressing. The only exception to this is when the master considers it essential to for the purpose of saving the vessel and he considers immediate action is required.

10. When overstressing due to high density cargoes has resulted in structural damage, on no account is any ballast or cargo to be pumped out or cargo adjusted/shifted until confirmation from office is received after obtaining advice from the vessel’s Emergency Response Service provider (LR ERS, RRDA etc).

11. Before attempting to rectify the overstressing caused due to high density cargo the plan must be carefully checked using the ship’s loading computer in order to check the criteria at every stage of the plan. The plan is to be agreed with the terminal operator before commencing the cargo operation.

12. In case vessel has exceeded the tank loading limit as allowed by vessel’s design and construction. The excess cargo to be transferred to other cargo tanks. In case no space is available in other tanks or the tanks are loaded to the maximum permissible load limit, the cargo has to be discharged either back to the terminal or lightering arrangements made as appropriate.

13. Once the stresses are reduced and brought within acceptable limits, further checks should be made in order to ensure that vessel remains with the allowable stress limits (Seagoing) for the remainder of the cargo operation.

Required documents:

- Ship’s “Trim and Stability Data/Manual” (Approved by Class)
- Ship’s “Procedures and Arrangements Manual” (Approved by Class)

8.3 Overfilling of Cargo Tank

All cargo tanks are fitted with a visual and audible high level alarm which indicated when the liquid level in the cargo tanks approaches the normal full condition (IBC 15.19.6). The high level alarm system is independent of the overflow control system and is independent of the gauging system. The tank overflow system shall come in operation when the normal tank loading procedures fail to stop the liquid level
exceeding the normal full condition and gives an audible and visual alarm tank overflow alarm.

The high level alarm as well as the tank overflow alarms to be tested prior each cargo operation and kept on throughout the cargo operations. The following procedure is to be followed in an event of overfilling of cargo tank.

1. Activate the agreed emergency shutdown procedure with shore/terminal during the Key meeting.
2. Advise the Terminal operator.
3. Determine the cause (e.g. incorrect or deviation from loading/discharging plan or technical cause such as valves or other cause) which has resulted in overfilling.
4. Check for available slack tanks containing same cargo or any available empty tanks.
5. Draft a plan for transferring the cargo from the overfilled tank to other suitable cargo tanks which have space to accommodate the cargo ensuring vessel remains within the allowable limits of stresses and stability at all times.
6. Minimise the trim and ensure vessel is kept upright.
7. Anti-pollution equipment to be in state of readiness and ensure adequate staff is available for implementing anti-pollution measures and cleanup of any cargo spilled on deck/superstructure due to overfilling of cargo tank.
8. Ensure all personnel are provided with suitable PPE required as per the cargo characteristics, MSDS.
9. The company to be kept fully advised of the situation.
10. Once the level in the tank is lowered with in the acceptable range, further checks to be made to ensure the
11. Determine the cause (e.g. incorrect or deviation from loading/discharging plan or technical cause such as valves or other cause) which has resulted in overfilling.
8.4 Polymerisation – Solidification of cargo

Care should be taken to ensure that cargo is sufficiently inhibited to prevent polymerization at all times during the voyage. When ship carries such cargoes, a certificate of inhibition in which the following items are shown should be given from the manufacturer of the cargoes:

1. Name & amount of inhibitor added
2. Date on which the inhibitor was added and duration of effectiveness.
3. Any temperature limitations qualifying the inhibitor’s effective lifetime.
4. The action to be taken should the period of voyage exceed the effective lifetime of the inhibitor.

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

The cargoes should not be loaded in 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.

In event of run-off polymerization, the following procedure to be followed:

1. Inform Office.
2. Provide the cargo characteristics, stowage plan and the details on tanks where polymerization is identified. The details of the cargo adjacent to the tank or tanks where polymerization has occurred to be provided (particularly cargoes which are sensitive to heat).
3. Reduce the temperature of the tank using boundary cooling.
4. Keep vessel ventilated to avoid overpressurisation of cargo tanks, which can result in structural damage. (Note: the cargo vents to be checked and confirm these are clear and not blocked due to polymer build up)
5. Suitable inhibitors appropriate for the cargo to be used after consultation with the office and authorization from Charterers.
6. In case of imminent danger, vessel to refer to the MSDS for the cargo for the quantity of inhibitor to use and the procedure for adding the inhibitor to the cargo.
7. Tank atmosphere and temperatures to be checked at regular intervals and the office, charterers and owners updated.
8. Ensure all personnel are provided with suitable PPE required as per the cargo characteristics, MSDS.
9. The company to be kept fully advised of the situation. The company will liaise with the class, flag state, coastal state, chemical experts and all stakeholders necessary to tackle the emergency situation.
8.5 Brittle Fracture

Normal shipbuilding steels rapidly lose their ductility and impact strength below 0 degree Celsius. For this reason, care should be taken to prevent cold cargo coming in contact with such steels, as the resultant rapid cooling would make the metal brittle and would cause stress due to contraction. In this condition the metal would be liable to crack. The phenomenon occurs suddenly and is called “Brittle Fracture”.

The following procedures to be complied with in event of Brittle Fracture

1. Immediately stop cargo and all other operations such as ballast and bunkers.

2. Advise terminal operator;

3. Advise office who will declare a contingency

4. Carefully check levels in all cargo oil tanks, ballast tanks, bunker tanks, FW tanks & Lub Oil tanks.

6. Ensure the data entered in the loading computer is accurate in order to determine the actual stress and stability condition and send the loadicator print out or duly filled up ERS form to the office and the emergency response service provider (e.g. LR SERS, RRDA)

8. The company is to be kept fully advised on the situation. The majority of tankers have contracts with damage stability providers (e.g. LR SERS) and assistance from them will be sought in most cases. They will require accurate data on the vessels tank status and weight distribution in order to perform these calculations.

9. Create a draft plan for correcting the situation. No action is to be taken without permission from the company who will be obtaining advice from the vessel’s Emergency Response Service provider (e.g. LR ERS, RRDA etc), particularly if structural damage has taken place due to over stressing. The only exception to this is when the master considers it essential to for the purpose of saving the vessel and he considers immediate action is required.

10. On no account is any ballast or cargo to be pumped out or cargo adjusted/shifted until confirmation from office is received after obtaining advice from the vessel’s Emergency Response Service provider (LR ERS, RRDA etc). The only exception to this is when the master considers it essential to for the purpose of saving the vessel and he considers immediate action is required.

11. In case any cargo has spilled on deck, the precautions as per the MSDS to be complied with all personnel provided appropriate PPE.
12. If the any cargo is released to sea, anti-pollution measures as per SMPEP/VRP and company’s MCCM manual to be initiated.

8.6 Tank Over-Pressure

It is a frequent practice at chemical loading ports to control the atmosphere in cargo tanks with nitrogen supplied from shore, for the purpose of drying a tank and its associated piping system, purging a tank before loading the cargo or padding cargo in a tank. The nitrogen may be supplied at high pressure (up to 10 bar) and at a high flow rate. Agreement on the procedure for handling the nitrogen is paramount, and should be part of the pre-loading checklist between ship and shore, with emphasis on a clear understanding of the transfer rate and pressure.

Although the operation is an important stage in cargo handling, it is also potentially hazardous because high pressure gas is being introduced into a tank which is not designed to withstand internal pressure, and whose structure may fail at less than 0.5 bar overpressure. The associated risks of the operation should therefore be thoroughly understood. Procedures should be in place to ensure safety during the operation, and all personnel involved should be made conversant with those procedures.

It is possible to overpressurise and even rupture a cargo tank if the nitrogen supply from shore is at too high a flow rate or too great a pressure. There have been incidents where structural damage has occurred.

Compressed gas is sometimes used by a terminal to press products out of shore tanks into the ship; there is an inherent risk of overpressurisation of ship’s cargo tanks. The gas pressure used for these operations varies, but can range between 2.5 and 5 Bar. The point of greatest concern is when the supply into the ship’s tank changes from liquid to compressed gas, causing an abrupt and dramatic increase in tank filling rate from liquid at a few hundred cubic meters per hour to gas at several thousand cubic meters per hour. Hence, overpressurisation of closed tank can occur in seconds, especially when distance from the manifold to the tank is small or the vapour space in the tank is limited.

Overpressurisation of cargo tanks can result in catastrophic structural failures, explosion hazards and cargo can release to sea causing pollution.

Tank over-pressure can also result from the following:

1. Self heating of cargo due to polymerization, rollover or with sensitive/reactive cargoes.
2. High loading rates (larger than vessel’s venting capacity or the designed maximum loading rates).
3. Thermal expansion of cargo at sea due increase of seawater and air temperatures during the voyage.
4. Failure of PV valves.
5. Clogging of vent pipes/PV valves (Due solidification of cargo/Polymerization).

Procedures to follow in case of tank overpressurisation:

1. If at alongside a berth/Terminal, activate the agreed emergency shutdown procedure with shore/terminal during the Key meeting.
2. Advise terminal operator; (If alongside at berth/Terminal)
3. Ventilate the tank via two PV valves until the pressure is restored back to normal. When alongside a berth/terminal, the terminal operator to be advised on the release of the cargo vapours.
4. If at sea turn the vessel and adjust the course and speed so as to bring the wind across the deck, directing the vapours away from the accommodation block.
5. Precautions to be in place as per the MSDS of the cargo. All ship staff to be provided with proper PPE.
6. Place a total ban on smoking and any hotwork, cease any operation which might produce source of ignition.
7. Investigate the reason for the tank overpressurisation. This can be due to polymerization, Rollover, sensitive/reactive cargoes, failure of PV valves, high loading rates, use of compressed gas by shore, during introduction of nitrogen into cargo tanks etc.
8. In case the tank overpressurisation has resulted in structural failure, pollution, explosion etc. The guidelines provided in MCCM manual, SMPEP and VRP (If in US waters to be followed).
9. The company is to be kept fully advised on the situation.
10. The tank to be inspected at the first opportunity for any structural damages due to tank over-pressure.

8.7 Rollover

Rollover is a spontaneous rapid mixing process which occurs in large tanks as a result of density inversion. Stratification develops when the liquid layer adjacent to a liquid surface becomes denser than layers beneath, due to boil off of lighter fractions from the cargo. This obviously unstable situation relieves itself with a sudden mixing, which the name “rollover” aptly applies.

Liquid hydrocarbons are most prone to rollover. No external intervention such as vibration, stirring or introducing new liquids is required to initiate “Rollover”. The response to small temperature difference within the liquid (which will inevitably occur in shipboard environment) is sufficient to provide the kinetic energy to start rollover, and release the gravitational driving forces which will invert the tank contents.

The inversion will be accompanied by violent evolution of large quantities of vapour and a very real risk of tank over-pressure.
If such circumstances are foreseen the tank contents should be circulated daily by cargo pumps to prevent rollover occurring.
Rollover can occur if compatible cargoes of different densities are put in the same tank. Rollover can be prevented by returning the cargo that is less dense than the bulk liquid on the top of the tank, and the cargo that is denser to the bottom of the tank.

If two part cargoes are loaded in a same tank having a large temperature difference and this will result in large boil-off and tank over-pressure.

Rollover can happen on a ship that has been anchored for some time. Rollover on a ship which is on passage is most unlikely.

In an event of rollover, the following procedures to be complied with:

1. Activate the agreed emergency shutdown procedure with shore/terminal during the Key meeting.
2. Advise terminal operator;
3. Advise office who will declare a contingency.
4. Ventilate the tank via two PV valves until the pressure is restored back to normal. When alongside a berth/terminal, the terminal operator to be advised on the release of the cargo vapours.
5. If at sea turn the vessel and adjust the course and speed so as to bring the wind across the deck, directing the vapours away from the accommodation block.
6. Precautions to be in place as per the MSDS of the cargo. All ship staff to be provided with proper PPE.
7. Place a total ban on smoking and any hotwork, cease any operation which might produce source of ignition.
8. The company is to be kept fully advised on the situation.
9. The tank to be inspected at the first opportunity for any structural damages due to tank over-pressure.
10. If any structural damage is evident or suspected, vessel to comply with the emergency procedures contained in MCCM, SMPEP and VRP (In US Waters).

8.8 Thermal Stress

Temperature changes cause the steel to either expand or contract. If temperature deformation is permitted to occur freely, no load or stress will be induced in the structure. In some cases where the temperature deformation is not permitted, an internal stress is created. The internal stress created is termed as thermal stress.

The main cause of thermal stress is rapid increase or decrease of temperature. The sensitive/reactive cargoes, run-off polymerization, rollover etc can result in exothermic reactions with rapid rise of temperature.

In case, structural failure or deformation of the strength members/scantlings is evident or suspected the following procedure to be complied with.
a. Immediately stop cargo and all other operations such as ballast and bunkers.

b. If at terminal, advise the terminal operator.

c. Carefully check levels in all cargo oil tanks, ballast tanks, bunker tanks, FW tanks & Lub Oil tanks.

d. Ensure the data entered in the loading computer is accurate in order to determine the actual stress and stability condition and send the loadicator print out or duly filled up ERS form to the office and the emergency response service provider (e.g. LR SERS, RRDA)

e. The company is to be kept fully advised on the situation. The majority of tankers have contracts with damage stability providers (e.g. LR SERS) and assistance from them will be sought in most cases. They will require accurate data on the vessels tank status and weight distribution in order to perform these calculations.

f. Create a draft plan for correcting the situation. No action is to be taken without permission from the company who will be obtaining advice from the vessel’s Emergency Response Service provider (e.g. LR ERS, RRDA etc), particularly if structural damage has taken place due to overstressing. The only exception to this is when the master considers it essential to for the purpose of saving the vessel and he considers immediate action is required.

g. On no account is any ballast or cargo to be pumped out or cargo adjusted/shifted until confirmation from office is received after obtaining advice from the vessel’s Emergency Response Service provider (LR ERS, RRDA etc). The only exception to this is when the master considers it essential to for the purpose of saving the vessel and he considers immediate action is required.

h. In case any toxic cargo has spilled on deck or release of toxic vapours, the precautions as per the MSDS to be complied with all personnel provided appropriate PPE.

i. If any structural damage is evident or suspected, vessel to comply with the emergency procedures contained in MCCM, SMPEP and VRP (In US Waters).

8.9 Emergency Discharge due loss of Pumpability

The Loss of pumping capability from a tank (cargo or ballast) can be considered due to the following condition.

- Damage to any Cargo pump.
• Failure of Hydraulic valve system.
• Unable to open any individual tank valve due to damage to hydraulic pipe.
• Chocked strainer of the pump
• Ingress of air in the Piping and pumping system. (Cavitation)
• Loss of pumpability due high viscosity/Solidification.

8.9.1 Damage to cargo pump:
In an event the reason for loss of pumpability is damage to the cargo pump, following guidelines to be complied with:

a) Immediately stop the damaged cargo pump.
b) Inform the terminal.
c) Isolate the damaged cargo pump and operate the other COP using the COP suction and discharge side crossover valves.
d) Due regard to be given in case vessel is carrying incompatible cargoes, ensuring no cargo contamination takes place due to inadequate line and valve segregation.
e) Office to be advised if there are concerns of cargo contamination.
f) The Chareters and Owners to be informed, prior using the alternative COP, in case of any possibility cargo contamination or cargo incompatibility.
g) The reasons for damage to the COP to be established and repairs carried out at the first suitably opportunity.

8.9.2 Loss of Pumpability due to failure of Hydraulic Valve System:
In event of failure of hydraulic valve system, the following procedure to be complied with

a) Use the emergency hydraulic pump for operation of the valves.
b) In case it is necessary to stop or reduce the discharge rate, inform the terminal operator.
c) Once the valves are open and lined up as per the cargo plan, restore the discharge rate and advise the terminal.
d) Establish the reasons for the failure of Hydraulic system and affect appropriate repairs.
8.9.3 Unable to open the tank valve due hydraulic line failure.

a) In case vessel is unable to open the individual tank valve due to hydraulic line failure, use the stripper valve for discharging the cargo.

b) Ensure vessel is maintained upright and good trim is maintained throughout.

c) Once the tank level comes down to stripping level, use the cargo eductors and auto stripping systems effectively to ensure the cargo oil pump does not cavitate or damage.

d) In case both the main and stripper valves cannot be opened due to hydraulic line failure, inform the terminal operator and the office to arrange for shore assistance, portable pumps for discharging the cargo.

e) The vessel’s Managers, Owners, Charterers and P&I local correspondents to be informed for appropriate follow up.

8.9.4 Loss of pumppability due to choked strainer

a) Stop the Cargo Oil Pump.

b) Inform the Terminal Operator.

c) Isolate the Cargo Oil Pump (Choked Strainer) pump and operate the other COP using the COP suction and discharge side crossover valves.

d) Due regard to be given in case vessel is carrying incompatible cargoes, ensuring no cargo contamination takes place due to inadequate line and valve segregation.

e) Office to be advised if there are concerns of cargo contamination.

f) The Charterers and Owners to be informed prior using the alternative COP, in case of any possibility cargo contamination or cargo incompatibility.

g) In case the COP (Choked Strainer) has to be used due to cargo segregation and incompatibility of different grades of cargoes. The Cargo operations to be stopped. The COP and the strainer to be stripped completely prior opening up the strainer cover. Terminal approval to be taken prior to the job and all safety measures of the Terminal as well as the control measures identified in the Risk Assessment to be in place.

h) The choked strainer to be cleaned. The Strainer Cover along with other openings and connections to be closed and restored as per original design.

i) Prime up the COP, ensuring all air is removed from the system prior operating the COP.
8.9.5 Loss of Pumpability due to Air entering the pipelines/COP (cavitation)

The vessel can suffer loss of pumpability due to air entering the pipelines and the cargo oil pumps due to either leaks in the pipe lines, dresser coupling or flanges, leaking valves in tanks which are emptied or due to vortex effect when discharging cargo as high rates.

The following measures to be taken in case of air ingress in the piping and pumping system.

a) The line and the cargo oil pump to be primed up again using the cargo from other tank which has high liquid column (Head).

b) The air to be removed from the COP and the level separators using the priming cocks provided and if necessary by using the auto strip system.

c) In case the pipeline in use is suspected to be holed, check for use of alternate cargo lines if possible to discharge (depending on vessel’s pipe line arrangement). Due regard to be given to cargo segregation and compatibility.

d) Start the COP at slow rate and gradually increase the discharge rate, ensuring sufficient back pressure is maintained by throttling the Cargo Oil Pump discharge valve. Due regard to be given to vortex effect, which results in air getting sucked in the cargo line, reduce the discharge rate accordingly.

e) In case the cargo in the tank to be pumped out is at a very low level, use the cargo eductors and/or auto stripping system to pump out the remaining cargo from the tank.

f) Establish the reason for the pump loosing suction and drawing air/cavitation and appropriate corrective measures to be implemented.

8.9.6 Loss of Pumpability due High Viscosity/Solidification of cargo (Heated Cargoes)

Loss of pumpability can occur if the temperature of the cargo falls below the pour point, particularly for heated cargoes or when discharging cargo in cold weather conditions.

The following to be taken into account to restore pumpability:

1. It has to be borne in mind Cargoes with a melting point less than 15°C: Discharge temperature must be at least 5°C above melting point of product. Example: Benzene, with a melting point of approx. 4.5°C, must be discharged at a min. temperature of 9.5°C if it is not to be considered “solidifying”. Cargoes with a melting point above 15°C: Discharge temperature must be at least 10°C above melting point of cargo. Example: Phenol, with a melting point of approx. 40.5°C, must be discharged at a min. temperature of 50.5°C if it is
not to be considered “solidifying”. Hence increase the heating steam to ensure the recommended temperature for discharge of cargo is maintained.

2. If the cargo goes below the steam coils and is is unpumpable then the tank must be filled up again to cover the steam coils, reheated and then discharged again.

3. Due consideration has to be given to minimize the temperature reduction of the heated cargo while taking ballast in the adjacent tanks. Ballast intake to be planned accordingly in order to avoid solidification while carrying heated cargo. Surface area exposed between the cargo and the ballast must be minimized. If possible, there should be no exposure of the ballast and cargo via the structure. This is to avoid any cooling effect which ballast water will have on the cargo which will cause solidifying of the cargo. Remaining ballast is to be only taken after the cargo has been fully discharged from the concerned cargo tank When ballasting double bottom tanks or side tanks with double bottom, the level of the ballast should be below the deck head (cargo tank bottom) till the cargo is discharged.

8.9.7 Portable Emergency Pump

For vessels fitted with deep well pumps, portable emergency pump is provided for pumping out the cargo in an emergency. The procedure is as follows:

PREPARATION AND STARTING

01. Remove the dust caps from the hydraulic couplings of the return hose and the portable pump.
02. Clean the couplings.
03. Slide the retaining ring and the lock ring backwards.
04. Fit the female coupling over the male coupling and release the retaining ring.
05. Verify that the couplings are properly locked.
06. Connect the pressure hoses accordingly.
07. Similarly connect the return and the pressure hoses to the main hydraulic line.
08. Remove the dust caps from the couplings of the cargo hose and the portable pump.
09. Clean the couplings.
10. Connect the cargo hose to the pump and one end to the cargo line.
11. Move and install the tripod to required location above manhole.
12. Operate the winch on the tripod and slacken the cable to connect to the portable pump.
13. Lower the pump into the tank.
14. Change the switch of fwd hydraulic pump to cargo pump operation.
15. Start the hydraulic pump.
16. Slowly open the hydraulic supply valve on the main hydraulic line pressure side.

17. Increase the rpm of pump using flow control valve. to increase the rpm rotate the valve clockwise.

MONITORING DURING OPERATION

01. Check the hydraulic pressure and flow.
02. Check the hydraulic hoses regularly for leakage.
03. Check the cargo hose regularly for leakage
04. Make sure the portable pump operates smoothly and steadily.

STOPPING

01. Stop discharging by turning the flow control valve anticlockwise.
02. Stop main hydraulic pump.
03. Slowly close the hydraulic supply valve.
04. Hoist the portable pump out of the cargo tank.
05. Disconnect the hydraulic pressure hose from the portable pump and hydraulic system.
06. disconnect hydraulic return hose from portable pump and hydraulic system
07. Disconnect discharge hose from portable pump and cargo line.
08. Clean the portable pump thoroughly before storage.
09. Install dust caps on all couplings and ports before stowage.

Note: When using the portable emergency pump for discharging toxic/corrosive or flammable cargoes, the precautions necessary as per the cargo MSDS has to be in place and ship staff to be provided with proper PPE required as per the information in the MSDS. The office has to be advised for appropriate advise & follow up prior using the portable emergency pump.
FLOW CONTROL

FEMALE COUPLING &
MAIN DECK

HYDRAULIC SUPPLY

HYDRAULIC

EMERGENCY PORTABLE

HOSE TO MAIN
APPENDICES

The Appendix section is for Checklists and procedures.

APPENDIX 1: CARGO TRANSFER PROCEDURE ................................................................. 1
  APP 1.1 OIL TRANSFER OPERATIONS AS PER US 33CFR 155.750 (A) (3)/(4)/(5) .................................................................................................................. 1
  APP 1.2 GENERAL........................................................................................................ 1
  APP 1.3 RESPONSIBILITY OF THE MASTER.......................................................... 1
  APP 1.4 RESPONSIBILITIES OF THE CHIEF OFFICER ................................. 1
  APP 1.5 RESPONSIBILITY OF THE CHIEF ENGINEER .................................. 2
  APP 1.6 DELEGATION OF DUTIES & RESPONSIBILITIES .............................. 3
  APP 1.7 OIL TRANSFER PROCEDURE 33 CFR 155.750 ...................................... 3
  APP 1.8 DESCRIPTION OF THE CARGO SYSTEM, OPERATIONAL AND EQUIPMENT PARAMETERS US CFR 33 155.750 (2) (I) (II) ....................... 5
  APP 1.9 CAPACITY AND METHODS OF DRAINAGE OF DRIP TRAYS .......... 8
  APP 1.10 BALLAST SYSTEM ............................................................................... 9
  APP 1.11 COMPLETE SHIP/SHORE CHECK LIST AND OTHER RELEVANT CHECKLISTS PRIOR COMMENCEMENT OF CARGO OPERATION .......... 10
  APP 1.12 BALLASTING CARGO TANKS .......................................................... 11
  APP 1.13 DISCHARGE OF DIRTY BALLAST .................................................. 11
  APP 1.14 DISCHARGING DIRTY BALLAST ..................................................... 12
  APP 1.15 DECANTING SLOP TANKS .............................................................. 13

APPENDIX 2 – SHIP SPECIFIC CHECKLISTS ............................................................... 1
  CHECKLIST NO. 1 – PRIOR DISCHARGE ...................................................... 1
  CHECKLIST NO. 2 - PRIOR LOADING ............................................................ 1
  CHECKLIST NO. 3 - DEPARTURE PORT ...................................................... 1
  CHECKLIST NO. 4 - HELICOPTER OPERATIONS ........................................ 1
  CHECKLIST NO. 5 - WEATHER MONITORING & HEAVY WX IN PORT .......... 1
  CHECKLIST NO. 6 - COLD-WEATHER CHECKLIST ....................................... 1
      (PRIOR ENTERING WINTER ZONE ) ............................................................... 1
  CHECKLIST NO. 7 - CONTINGENCY PLANNING FOR STS OPERATIONS .... 1
  CHECK LIST NO. 8 – DURING LOADING / DISCHARGING OPERATION (HAZARDOUS CARGO) ......................................................................................... 1

APPENDIX 3 (A) - BUNKER TRANSFER PROCEDURES .............................................. 1
  1.0 BUNKERING TRANSFER PROCEDURES ............................................... 1
  1.1 PERSONNEL AND THEIR DUTIES ..................................................... 1
      1.1.1. OVERALL IN CHARGE - CHIEF ENGINEER ..................................... 1
      1.1.2. ASSISTANT TO CHIEF ENGINEER - BUNKER OFFICER (3RD OR 4TH ENG. AS NOMINATED BY C/E) ...................................................... 1
CHECKLIST NO. 2 : TOXIC LIQUID RELEASE AT THE TERMINAL .................. 1
CHECKLIST NO. 3 : TOXIC LIQUID RELEASE AT SEA ........................................ 1
CHECKLIST NO. 4 : BREAKAWAY FROM JETTY DURING CARGO TRANSFER ... 1

(!) APPENDIX 6 - WALLEM MARPOL COMPLIANCE PROGRAM (WMCP) ...................... 1
(!) APPENDIX 7 - SAFETY OFFICER INSPECTION CHECKLIST .................................... 1
(!) APPENDIX 8 - PRIVATE MARITIME SECURITY COMPANY (PMSC ) PROCEDURES ...... 1
APPENDIX 1: CARGO TRANSFER PROCEDURE

APP 1.1 OIL TRANSFER OPERATIONS AS PER US 33CFR 155.750 (A) (3)/(4)/(5)

App 1.2 GENERAL
These standing orders apply to all personnel engaged in oil transfer operation. In addition to loading and discharging of oil cargoes, transfer operation shall be understood to include ballasting and de-ballasting, tank cleaning and preparation of cargo tanks for loading cargo as well as Crude Oil Washing.

The following standing orders have been drawn up so as to comply with United States Coast Guard regulations.

A copy of these standing orders shall be permanently maintained in the cargo control room and shall be available for inspection by U.S.C.G., Port Officials and ship’s personnel.

App 1.3 RESPONSIBILITY OF THE MASTER
The Master shall hold overall responsibility for the Safety and Security of the personnel, vessel and cargo under his command while at the same time ensuring that the vessel complies with all environmental regulations.

He is responsible for ensuring that all regulations laid down by the Company, Local Authorities, Governments and International Organizations are fully complied with at all times.

App 1.4 RESPONSIBILITIES OF THE CHIEF OFFICER
The Chief Officer is directly responsible to the Master for the safety of the oil transfer system & the safety of the oil transfer operation.

Personnel delegated for the duty watchkeeping during cargo oil transfer operations are directly responsible to the Chief Officer and shall discharge such orders as instructed by the Chief Officer.
Tests for integrity of the cargo oil transfer system shall be periodically carried out as laid down in the Code of Federal Regulations (CFR33). Any shortcomings are to be reported to the Master immediately.

The Chief Officer along with the Chief Engineer is directly responsible for the correct & safe operation & use of the vessel’s inert gas system.

The Chief Officer is to ensure that IGS is in continuous operation during transfer operations as deemed necessary & that the atmosphere in the cargo tanks is maintained under 5% of O2 and at a positive pressure above 100 mm W.G. at all times.

The Chief Officer is responsible for safe execution of crude oil washing operations whenever this is to be effected during discharge of crude oils.

The Chief Officer shall draw up a detailed program prior to each crude oil washing operation & submit same to the Master and the terminal. Guidelines for COW programs are given in the vessel’s crude oil washing manual.

As the Deputy Ship Security Officer he is to ensure that the vessel complies with the Security requirements as given in the Company’s Ship Security Plan.

**App 1.5 RESPONSIBILITY OF THE CHIEF ENGINEER**

The Chief Engineer is responsible for ensuring that all engine and deck machinery is in good working order and condition.

He is also responsible for the safe & smooth execution of all fuel oil, diesel, gas oil & lubricating oil bunker transfer operations. For details on bunker procedures, see SBM II.

He is to ensure that there is close co-operation between the deck and engine departments in order that all operations are carried out in a smooth manner.

If he is also the Ship Security Officer then he is to ensure that the vessel complies with the Security requirements as given in the Company’s Ship Security Plan.
App 1.6 DELEGATION OF DUTIES & RESPONSIBILITIES

Salient Watch Keeping Instructions:
The Duty Officer holds responsibility for his watch & shall carry out all instructions as directed by the Chief Officer. Any irregularities, shortcomings, defects & similar occurrences shall be brought to the immediate attention of the Chief Officer.

No oil transfer shall commence prior to all items of the safety check list being read and fully understood. Sea valves, overboard valves & manifold valves shall never be operated by the duty watch personnel unless expressly instructed by the Chief Officer, except shut-down of same if deemed necessary in an emergency.

The Duty Officer shall ensure continuous & effective deck and manifold watches are maintained taking patrol rounds himself whenever the central cargo operations room is manned by Chief Officer.

The Duty Officer shall delegate one of his watch ratings to maintain continuous watch at the cargo manifold. The rating should be provided with means of communication (ie VHF/UHF radio), whilst the other rating of his watch shall maintain continuous deck patrol. When the vessel is on a SPM a continuous watch for the Buoy to be kept at the Foc'sle Deck.

The deck patrol rating shall also be equipped with means of communication (VHF/UHF radio). This rating shall ensure vessel's mooring lines are in order. Periodic reporting system between members of the duty watch shall be drawn up at the beginning of each watch and then effected throughout the watch.

App 1.7 OIL TRANSFER PROCEDURE 33 CFR 155.750

i. This vessel is mainly involved in the carriage of Methanol. Generic and safety information for grade as per the attached data.

2. This vessel is a standard chemical/oil tanker. There are 20 full segregated cargo tanks and 2 slop tanks. Each tank equipped with separate FRAMO pump and each tank pairs (as 1P & 1S, 2P & 2S, etc.) equipped with separate pipelines. Tanks and pumps can be interconnected by various loops on manifold and with port and stbd common lines. Schematic diagrams for pipelines are located in the cargo control room.
3. This vessel has a segregated ballast system independent of cargo pumps and lines. SBT tanks: Forepeak, 1WP, 1WS, 2WP, 2WS, 3C, 3WP, 3WS, 4C, 4WP, 4WS, 5C, 5WP, 5WS, 6WP, 6WS and Aft Peak. Ballasting/deballasting can be done concurrent with cargo operations.

4. Manifold containment is in drip trays which can be drained into slop tanks. Cargo overflows/leaks onto deck can be pumped into slop tanks (other containers) by means of Wilden pumps located at the break of accommodation port & stbd.

5. 5 persons will be on duty during any cargo transfer operation:
   - Person in Charge: Chief Officer
   - Asst. in Charge: Duty Officer & pumpman
   - Deckhands: 2 persons (bosun, Abs, OS & TNO)

6. One deck hand with walkie talkie will always be at cargo manifold, the other one to be attending to moorings and antipollution watch. Pumpman’s duty will be directed by Duty Officer or Chief Officer. Additional crew will be called & used as conditions demand.

7. In any emergency, cargo operations to be stopped immediately. Cargo pumps can be tripped using emergency stops at cargo control room, both sides of manifolds, Forecastle and Poop deck areas.

8. Communication is by 8 UHF walkie talkie sets with key persons.

9. Cargo tanks will be topped up using Hermetic Portable Cargo Monitoring Equipment/remote readout at the cargo control room. Gauges’ accuracy to be verified when ullage is 2.5 metres. After topping up a tank, watch that the ullage is steady and confirm no more cargo coming in. All tanks are also fitted with independent high-high level alarms, these are float sensing type (98% per cargo tank). This gives a audible and visual alarm on the main deck (fitted on bridge-front) and in the Cargo Control Room.

10. Tanks to be under positive Pressure at all times.

11. Once transfer operations are complete, Chief Officer will personally check that all valves opened during the operation are now shut.

12. In the event of any oil spill or discharge, sound the ‘Emergency Alarm’ stop cargo operations and inform Master, also advise terminal. Local U.S.C.G. Group is to be informed on V.H.F. Channel 16 of situation. It is most important to contain any spill on deck. Do not spray any
chemical in water unless U.S.C.G. or Port Authority gives permission. Be familiar with ship’s oil spill containment equipment and location. Proceed as per Vessel Response Plan / S.O.P.E.P.

App 1.8 DESCRIPTION OF THE CARGO SYSTEM, OPERATIONAL AND EQUIPMENT PARAMETERS US CFR 33 155.750 (2) (i) (ii)

Reference ship’s drawing no.5105da800d101, diagrammatic Arrangement of cargo oil & water ballast system (note: copy of this drug is conspicuously posted in cargo Operations control room on accommodation a-deck).

MAIN FEATURES OF THE OIL TRANSFER SYSTEM

The Cargo system in this vessel consists of a total of 20 cargo tanks and 2 dedicated slop tanks. The cargo tanks are arranged as 10 pairs of wing tanks. The vessel is a double hull vessel with six pairs of wing tanks, 3 DB Centre and Fore Peak and Aft Peak arranged as segregated ballast tanks. This satisfies the regulations of the MARPOL 73/78 Convention regarding segregated ballast with protective location. The two slop tanks are arranged aft of cargo tanks.
STRIPPING SYSTEM

Auto Unloading System

Unloading System
Each cargo tanks including slop tanks arranged by separate FRAMO pump and can be used separately or in parallel.

Cargo Stripping
The vessel has a separate stripping line from every tank and stripping of cargo following according general FRAMO instruction.

VAPOUR EMISSION CONTROL SYSTEM (VECS):
Vessel is fitted with vapour emission control system. Four vapour connections in the cargo manifold area are installed and painted according to OCIMF standards. The VECS has the following features:

1) Four sets of Principal reducers size 600X400 and two sets of reserve reducers, size 600X300mm. This line is connected to the I.G. main line system, branching to each cargo tank and to a gas riser.
2) An OVS-OP 30 sampling system, analyzing waste vapour gas for oxygen %age and Pressure.

The alarm unit gives the following alarms:
  a) Oxygen High.
  b) Flow fail.
  c) Vapour Pressure High.
  d) Vapour Pressure Low.

The Vapour emission control system has two functions:
  i. Monitoring of vapour emission from cargo tanks during loading when vapours are led to shore installation. The Omicron independent high alarm system gives warning of oil overflow from a tank getting into I.G line, thus avoiding any risk of cargo going into the shore reception facility along with the vapours.
  ii. Monitoring of vapour emission from cargo tanks during loading when vapours are led to shore installation. The Omicron independent high alarm system gives warning of oil overflow from a tank getting into I.G line, thus avoiding any risk of cargo going into the shore reception facility along with the vapours.

B. The OVS-OP 30 monitors the vapours being received during lightering operations from daughter vessel, if required. Thus a control over the quality of vapour received can be maintained.

VALVE REMOTE CONTROL SYSTEM:
The vessel is fitted with an Electro hydraulically controlled Valve Remote Control system (VRC), to operate Cargo and Ballast valves from the CCR. Pressurised oil generated from the Power Pack is directed into the opening or closing chambers of the jack, actuating the valves through solenoid operated control valves.
The system comprises the following:
   a) Hydraulic Power Pack
   b) Solenoid valve rack. (installed in safe area)
   c) Upper Deck Boxes.
   d) Control Console.
   e) Monitored Safety Box Valves.
   f) Emergency Hand Pump.

The hydraulic power pack can be selected for constant running only, where the selected motor pump is constantly running. Its pressure & flow compensator control automatically adjusts pump delivery pressure between 0 & 25 ltr per minute, to maintain volume requirements of the system, at the pre-selected operating pressure of 150 bar.

The maximum pressure in the circuit is limited to 168 bar, by the relief valve.

The following alarms are fitted:
   • High pressure (160 bar)
   • High Temperature (70 deg. Celsius)

An alarm sounds, and the automatic motor pump changes in case of:
   • Low pressure alarm (140 bars).
   • Overload of selected motor pump.

An alarm sounds, and the automatic motor pump set stops, in case of:
   • Low level alarm (The timer allows up to 1 minute operation after alarm).
   • Over load on both motors.

The pump allows one opening/closing of three largest valves simultaneously in 65 secs.

Emergency operation:
In case of lack of voltage, operation can be performed from the emergency manual control on the solenoid valves.
In case of lack of Hydraulic pressure, by connecting the Emergency hand pump at the following:
   iii. On the provided block in the solenoid valve rack or boxes and acting on the emergency manual override of the solenoid valve (The main delivery stop valve should be closed)
   ii) On the block of the safety boxes for submerged valves (main delivery valve closed)
   iii) On actuator sub plate. (For non-submerged valves)
CARGO TANK VENTING SYSTEM:

Each cargo tank is fitted with a PresVac Hi-Lift Hi-Velocity Pressure/Vacuum Valve set for lifting at positive pressure of 1400 mmAq & vacuum pressure of -350 mmAq.

These approved P/V valves are provided internally with Flame screens complying with above regulations.

Each Cargo tank & SBT is fitted with an Oil Tight Hatch; these hatches are provided with solid NBR sealing seats & must be kept closed at all times.

Further, Tank clean ports, steam heating line penetrations, Vapour control valve penetrations, valve remote system hyd fluid pipeline penetrations, temperature sensors & level gauge sensor cable conduct penetrations are to be maintained gas tight by periodic visual inspection & soap solution test.

Vessel underway or at anchor:

iv. Oil Tight Hatches on all tanks to be kept closed. These can be opened only under express instructions of Ch. Off. If vessel is loaded or tanks gassed, then express permission of the Master has to be sought.

2. All cargo system valves connected with the IG system to be kept closed & lashed; these valves can be opened only when necessity of purging via cargo line exists & to be operated only under the instructions of the Chief Officer.

ALL OTHER OPENINGS THROUGH WHICH HYDROCARBON VAPOURS OR LIQUIDS MAY BE RELEASED MUST BE KEPT CLOSED AT ALL TIMES!
THIS VESSEL IS FULLY EQUIPPED & CAPABLE OF CONDUCTING ANY OIL TRANSFER OPERATION UNDER FULLY HERMETICALLY CLOSED CONDITIONS.

App 1.9  CAPACITY AND METHODS OF DRAINAGE OF DRIP TRAYS

v. Upon completion of loading/discharging, the contents of loading arms are dropped directly into 4ws or into the drip trays located at the manifolds. This is done by opening the necessary small diameter discharge line valve for each main line (i.e. Marpol line valve located forward of each manifold valve) and opening the
hydrant valve to the drip tray. The capacity of each of the manifold drip trays is 11.60 M3 = 73 bbls. The contents of the drip tray can thereafter be drained into cargo tanks No.4 Wings by gravity by opening the manual valve to the tank. “U” tubes are fitted to these drain lines, inside 4ws COTs, to prevent backflow in case of high IG pressure in tanks.

In the event of water collecting in the drip tray, contents can be drained onto deck (under supervision of Duty Officer) by opening manual valve located aft of drip tray.

(2) While bunkering amidships, contents of arms can be dropped into drip trays of manifold and drained into 4w tanks as described above. If bunkering is to be done aft (forward of accommodation), drip trays are provided each side capacity 2.33 M3 = 14.70 Bbls. Contents of the drip tray can be pumped into any cargo/bunker tank using Wilden pump which is readily available during cargo/bunker operations located strategically in pump room. Water collection in drip tray can be drained onto deck (under supervision) by opening of manual drain plugs provided.

App 1.10 BALLAST SYSTEM

The vessel complies with the regulations for segregated ballast with protective location of the ballast tanks and carries segregated ballast in the Upper Fore Peak tank, Lower Fore Peak tank and in six pairs of wings tanks.

The ballast tanks are served by two centrifugal, dual speed electrically driven ballast pumps each having a capacity of 2000/1500 m3/hr. When ballast comes down to stripping level the pumps to be changed over from high to low speed in order to get better stripping results. In order to do this the pump has to be stopped and then restarted at low speed. A maximum of three starts can be attempted in one min. After this, the next start can be attempted only after an interval of twenty minutes. Segregated ballast can also be taken in the Aft Peak tank.

This is served by a pump in the engine room having a capacity of 400 m3/hr. Emergency deballasting can be achieved via a connection with a N/R valve and spool piece arrangement between the cargo and ballast systems in Pumproom. The segregated ballast tanks have a total capacity of 54,559.90 m3, giving the vessel a ballast draft which satisfies the requirements stipulated in Annex 1 of MARPOL 73/78.

Ballast water is not normally allowed to be carried in the cargo tanks, except if this should become necessary under extreme weather
conditions, as permitted by Regulation 13(3) of annex of MARPOL 73/78. Such ballast water must then be treated as oily water and the discharge thereof be handled by the cargo pumping and piping system, and be monitored by the oil discharge monitoring and control system. Cargo tanks 4W are designated as the normal heavy weather ballast tanks.

THE MANIFOLD VALVES AND SEA SUCTION VALVES ARE TOTALLY MANUAL WHILST THE OVERBOARD VALVE ON THE CARGO SYSTEM IS CONTROLLED BY THE OIL DISCHARGE MONITORING & CONTROL SYSTEM. HOWEVER THIS VALVE IS USUALLY TO BE KEPT CLOSED AND A BLANK IS FITTED ON THE OUTBOARD SIDE OF THIS VALVE.

SBT SYSTEM SEA VALVES ARE ALL MANUALLY OPERATED, IN PUMPROOM. OPERATION OF ANY SEA VALVE WILL BE UNDERTAKEN SOLELY BY THE CHIEF OFFICER UNLESS IT IS REQUIRED TO SHUT SAME IN AN EMERGENCY AT WHICH TIME CHIEF OFFICER TO BE INFORMED IMMEDIATELY!

OPERATION OF MANIFOLD VALVES SHALL ALSO BE UNDER THE EXPRESS INSTRUCTIONS OF THE CHIEF OFFICER UNLESS DEEMED NECESSARY TO SHUT SAME IN AN EMERGENCY.

BALLAST TANK VENTING SYSTEM AND GAS DETECTION SYSTEM
The vessels ballast line system has a connecting elbow piece with the I.G. piping system. This spool piece can be connected so as to use the I.G. fans in fresh air mode for ventilating the segregated ballast tanks through the bottom ballast lines.

The longitudinal Centre line bulk head dividing the Port and Stbd Ballast tanks has manholes which open alternately from port and stbd. W B Tks. These manholes assist in thorough ventilation of the D.B.tanks. There are four manholes per tank.

The Ballast tanks, cofferdam and pump room void spaces are equipped with a gas sampling system (Consilium). This will continuously monitor the atmosphere in all the aforementioned spaces. Before taking ballast, the sampling of the ballast tanks should be switched off and the cocks on the pipe lines are to be shut.

App 1.11 Complete ship/shore check list and other relevant checklists prior commencement of cargo operation.
SHIP/SHORE CHECKLIST
Use Form D23.

App 1.12 BALLASTING CARGO TANKS

No. 4W tanks are designated for taking in heavy weather ballast. The ballasting operation should be discussed and agreed in writing between ship, the charterers and terminal.

The cargo tanks in which ballast has to be taken must be crude oil washed. Emergency jumper connection between ballast & cargo system to be fitted in Pumproom (painted red colour) OR Sea Suction blank on cargo sea line to be removed. Tank valves for 4P & 4S COT to be opened.

Cargo pumps to be started prior opening of sea valves, with vacuum pump running. Pumps are to be slowed down sufficiently in advance of tanks being filled, in order to avoid overflow from tanks being ballasted. Ample ullage space to be left in tanks, even if this means having to top them to normal ullage after departure.

When ballasting in non gas free cargo tanks, the gas must be vented through vent riser.

App 1.13 DISCHARGE OF DIRTY BALLAST

This vessel is an SBT tanker, however if ballast is taken in cargo tanks on account of heavy weather or the charterer’s requirements, in such cases, discharge of dirty ballast must always be performed according to Regulation 9 of Annex I Chapter II of Marpol 73/78.

Quote:

“Discharge of oil or oily mixtures from ships shall be prohibited except when all the following conditions are satisfied:
A. Tanker is not within a special area.
B. Tanker is more than 50 nautical miles from nearest land.
C. Tanker is proceeding en route.
D. Discharge of oil content does not exceed 30 litres per nautical mile.
E. Total quantity of oil discharged into the sea does not exceed 1/30000 of total quantity of particular cargo.
F. ODME should be operational.”

Unquote

Note: Discharge of “dirty” ballast is prohibited in special areas.
Procedures
Discharge of dirty ballast at sea must always be performed under strict control of pumping procedures.

1. Before discharging the dirty ballast overboard, flush the main cargo lines to be used for discharging dirty ballast into the slop tank.
2. Before flushing, prime the system, establish suction, stop the pump, close all valves and allow the oil from the pipe walls to separate out.
3. Resume pumping after half an hour at moderate rate.

App 1.14 DISCHARGING DIRTY BALLAST

1. Commence discharge dirty ballast.
2. Reduce discharge rate from individual tanks on approaching a water depth of about 20% of the tank depth.
3. Reduce pumping rate.
4. Observe carefully trend of oil monitor reading.
5. Stop discharge of individual tank when a level is reached that is known not to give any entrainment of oil.
6. Transfer remaining dirty ballast into the slop tank using the stripping system.
7. After sufficient settling time (heating improves settling) the stripping pump is to be used to decant slop tanks as per Section 2.14.

Engine Room Bilges
Vessel can only transfer oil from the bilge tank can only be transferred to slop tank, if mentioned in the IOPP Form B.
App 1.15 DECANTING SLOP TANKS

Decanting of slop tanks is a critical step in the retention of oil on board. Even a short delay in stopping a pump or closing a valve can allow oil to escape into the sea.

Time required for oil and water to separate in the slop tank depends on the motion of the ship, temperature and type of cargo. Under favorable conditions a few hours may be enough but in most circumstances up to 36 hrs should be allowed.

Discharge from the slop tank must cease well before the interface is reached. Carefully the trend of the oil monitor reading.

The pumping rate is to be reduced to a minimum well in time, before the oil/water interface is reached. If oil should appear before the predetermined ullage is reached, stop pumping immediately.
APPENDIX 2

SHIP SPECIFIC CHECKLISTS

CHECKLIST NO. 1 – PRIOR DISCHARGE ........................................................................ 1
CHECKLIST NO. 2 - PRIOR LOADING ......................................................................... 1
CHECKLIST NO. 3 - DEPARTURE PORT ..................................................................... 1
CHECKLIST NO. 4 - HELICOPTER OPERATIONS ..................................................... 1
CHECKLIST NO. 5 - WEATHER MONITORING & HEAVY WX IN PORT ....................... 1
CHECKLIST NO. 6 - COLD-WEATHER CHECKLIST (PRIOR ENTERING WINTER ZONE) ................................................................. 1
CHECKLIST NO. 7 - CONTINGENCY PLANNING FOR STS OPERATIONS ............... 1
CHECKLIST NO. 8 – DURING LOADING / DISCHARGING OPERATION (HAZARDOUS CARGO) ........................................................................................................ 1
# Checklist No. 1 – Prior Discharge

## Vessel Name:  

## Port:  

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Cargo Discharge Plan (including Ballast Operations) ready and confirmed by Master?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Oil Record book (Part 2) up to date?</td>
<td></td>
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<tr>
<td>3.</td>
<td>All valves in the cargo system are shut prior to lining up?</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>4.</td>
<td>Ballast Management Log up to date?</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>5.</td>
<td>Officers and Crew briefed?</td>
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<tr>
<td>6.</td>
<td>Is the vessel with acceptable stability and stress?</td>
<td></td>
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<tr>
<td>7.</td>
<td>Portable gauging equipment ready for use?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8.</td>
<td>Oxygen meters calibrated and ready for use?</td>
<td></td>
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<tr>
<td>9.</td>
<td>Walkie-talkies ready for use?</td>
<td></td>
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<tr>
<td>10.</td>
<td>Safety plan at Manifold and warning board displayed?</td>
<td></td>
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</tr>
<tr>
<td>11.</td>
<td>Is the fire fighting equipment rigged and ready for immediately use?</td>
<td></td>
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<tr>
<td>12.</td>
<td>Pilot ladder, gangway, life ring w/light checked and ready?</td>
<td></td>
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<tr>
<td>13.</td>
<td>Midship Cargo Hose Cranes Tested for satisfactory operation &amp; overload Trips</td>
<td></td>
<td></td>
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<tr>
<td>14.</td>
<td>All external doors, vents, E.R. skylight closed, A.C. on partial recirculation?</td>
<td></td>
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<tr>
<td>15.</td>
<td>Garbage drums on deck covered and Garbage Record book up to date?</td>
<td></td>
<td></td>
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<tr>
<td>16.</td>
<td>Radio and radar transmitters switched off and equipment grounded?</td>
<td></td>
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<tr>
<td>17.</td>
<td>Vessel earthed?</td>
<td></td>
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<tr>
<td>18.</td>
<td>Deck scuppers plugged?</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>19.</td>
<td>Are all drains on both Spill Tanks fully closed? Tanks empty?</td>
<td></td>
<td></td>
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<tr>
<td>20.</td>
<td>Air-driven pumps on both side aft Cargo deck and Oil spill containers ready?</td>
<td></td>
<td></td>
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<tr>
<td>21.</td>
<td>Cargo &amp; Ballast pumps tested and ready for use?</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>22.</td>
<td>Check setting of pump temperature trips and alarms is based on the flash point of the cargo.</td>
<td></td>
<td></td>
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<tr>
<td>23.</td>
<td>COP and I.G. gauges (Both remote and local) are checked and at manifold where gauges not fitted, plugs in position. Remove covers from the manifold pressure gauges.</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>24.</td>
<td>Independent High – High level alarms to try out and check in order.</td>
<td></td>
<td></td>
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<tr>
<td>25.</td>
<td>Cargo Remote level gauging high and low level alarms to check is order</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>26.</td>
<td>The cargo tank pressure sensors are set correctly and checked for satisfactory operation (If fitted)</td>
<td></td>
<td></td>
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<tr>
<td>28.</td>
<td>Is the cargo lines Pressure Test not expired?</td>
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<tr>
<td>29.</td>
<td>Lower I.G pressure for gauging/river transit to below 200 mm (if applicable)</td>
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<tr>
<td>30.</td>
<td>Hydraulic System for Cargo valves operations, oil level checked?</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>31.</td>
<td>All Manifold connections checked by OOD and ready for Operations?</td>
<td></td>
<td></td>
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<tr>
<td>32.</td>
<td>Manifold area, Ballast Room atmosphere Gas detector ready?</td>
<td></td>
<td></td>
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<tr>
<td>33.</td>
<td>Are P/V valves (or Vapor Return line) ready for Operations?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>34.</td>
<td>Is the Ship/Shore safety Check list signed prior discharging?</td>
<td></td>
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<tr>
<td>35.</td>
<td>Is the Ship/Shore Discharge Agreement signed prior discharging?</td>
<td></td>
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</tr>
<tr>
<td>36.</td>
<td>Is AIS and VHF on low power?</td>
<td></td>
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<tr>
<td>37.</td>
<td>Is Manifold clear of all non-metallic containers and pans which are not grounded?</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>38.</td>
<td>Are all unused manifold valves shut and piping blanked with pressure gauge in full operational view for check during security and safety rounds?</td>
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</tr>
<tr>
<td>40.</td>
<td>Pumproom gas alarms and Bilge alarm checked.</td>
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<tr>
<td>41.</td>
<td>Pumproom entry checklist filled?</td>
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<tr>
<td>42.</td>
<td>Is the pumproom bilge system set so that it is operational from pumproom top?</td>
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</tbody>
</table>

**NOTE:** Ship - Shore Safety Checklist Form D-23 to be filled out prior operations.

---

**Chief Officer**  
**Chief Engineer**

**2nd Officer**  
**Bosun**  
**Electrician**

**3rd Officer**  
**Master**  
**Pumpman**
# Checklist No. 2 - Prior Loading

**Vessel Name:**

**Port:**

**Date:**

<table>
<thead>
<tr>
<th>NO.</th>
<th>Description</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
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<tbody>
<tr>
<td>1</td>
<td>Cargo Loading Plan (including Ballast Operations) ready and confirmed by Master?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Cargo / Oil Record book up to date?</td>
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<td>3</td>
<td>Ballast Management Log up to date?</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>For Pressure sensors provided for COT's as means of secondary protection are the alarm settings correct? Note: The pressure sensors alarms should be set to activate as stated in Tanker operational Manual section 2.9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Is the Ship/Shore safety Check list signed prior loading?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Is the Ship/Shore Loading Agreement signed prior loading?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Is the Cargo Safety Data Sheet delivered by Loading Master prior loading?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>Is AIS and VHF on low power?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>Is Manifold clear of all non-metallic containers and pans which are not grounded?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Are all unused manifold valves shut and piping blanked with pressure gauge in full operational view for check during security and safety rounds?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Pump Room Bilges dry/clean. All Pumproom lights/shades checked. One flashlight kept at pumproom bottom.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Pumproom gas alarms and Bilge alarm checked.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Pumproom entry checklist filled?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Is the pumproom bilge system set so that it is operational from pumproom top?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** Ship - Shore Safety Checklist Form D-23 to be filled out prior operations.

---

**Chief Officer**  
**2nd Officer**  
**3rd Officer**  
**Chief Engineer**  
**Electrician**  
**Pumpman**  
**Bosun**  
**Master**
# Checklist No. 3 - Departure Port

**Vessel Name:**

**Port:**

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Yes</th>
<th>No</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>All crew members on board and accounted for.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>FFA equipment / special equipment restowed for sea.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3.</td>
<td>Vessel checked for stowaways - Entry in logbook.</td>
<td></td>
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</tr>
<tr>
<td>4.</td>
<td>Oil spill equipment restowed for sea.</td>
<td></td>
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</tr>
<tr>
<td>6.</td>
<td>Heavy weather lashings taken, if weather warrants all rooms/stores on deck properly closed.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>7.</td>
<td>Pilot access ladder / combination, secured for sea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Accommodation ladders secured for sea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Moorings systems – power switched off / Mooring ropes covered with canvas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Deck scuppers to be opened once clear of Port limits.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>11.</td>
<td>All loose gear restowed / secured for sea</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Sounding pipe caps checked / closed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Drip trays / save all trays - plugs unshipped</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>If in heavy ballast top up the specific heavy ballast tanks for the ship</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>15.</td>
<td>Check Eye showers on deck are secured and operational</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>16.</td>
<td>Check lashing / securing arrangement of lube oil drums on the deck aft and garbage drums on poop deck</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>When leaving a port with known stowaway problems, carry out a thorough stowaway check again after Drop of Pilot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>All Cargo lines are well drained and that no shift of cargo takes place</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>19.</td>
<td>Canvas covers are put on PV valves, Tank domes and Butter worth openings depending on the cargo</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>20.</td>
<td>Nitrogen if used for padding then Nitrogen pressure is maintained</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21.</td>
<td>MMC, Sounding tapes are well cleaned and secured</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO.</td>
<td>DESCRIPTION</td>
<td>YES</td>
<td>NO</td>
<td>N/A</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>22.</td>
<td>If vessel equipped with Framo system that Framo pumps are purged</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>23.</td>
<td>Stability condition for Departure port printed out and filed</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>24.</td>
<td>All valves in pumproom and deck are secured</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25.</td>
<td>Cargo samples secured in designated Sample locker</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26.</td>
<td>Hose handling, Provision cranes and Bunker davits hooks properly secured</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>27.</td>
<td>Draft gauge valves are shut</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>Loose equipment in Lifeboat secured for sea</td>
<td></td>
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<tr>
<td>29.</td>
<td>If vessel in loaded condition the Ballast tank gas monitoring system is on</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Chief Officer

Second Officer

Third Officer

Verified by Master
CHECKLIST NO. 4 - HELICOPTER OPERATIONS

VEssel NAME: 
PORT: 
DATE: 

PROCEED TO ASSIGNED STATION AS ORDERED. WEAR HELMETS AND NECESSARY PROTECTION EQUIPMENT, AND HAVE ALL NECESSARY FIRE FIGHTING AND SAFETY EQUIPMENT READY FOR USE.

<table>
<thead>
<tr>
<th>RANK</th>
<th>ASSIGNMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>C/O</td>
<td>Squad leader in charge of the operation. Reports to Bridge when squad is ready.</td>
</tr>
<tr>
<td>BOSUN</td>
<td>Standby with wire cutter &amp; crow bar in position.</td>
</tr>
<tr>
<td>A/B</td>
<td>Wear fire protection suit</td>
</tr>
<tr>
<td>A/B</td>
<td>Wear fire protection suit</td>
</tr>
<tr>
<td>2nd Engineer</td>
<td>Standby at the Foam monitor.</td>
</tr>
<tr>
<td>O/S</td>
<td>Bring fire hoses, nozzles and Extinguisher.</td>
</tr>
<tr>
<td>DUTY ENGR.</td>
<td>Standby in foam room.</td>
</tr>
</tbody>
</table>

NOTE:
All vessels to fill up the checklist given in the “Guide to Helicopter/Ship operations” which is an ICS publication.

_________________________  ________________________
Duty Officer              Master
**CHECKLIST NO. 5 - WEATHER MONITORING & HEAVY WX IN PORT**

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Duty Officer to take rounds of Wheelhouse every 2 hrs, logging weather.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>If barometer drops by over 3 mb, or wind speed increases by over 5 kts, inform Master.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Master monitoring weather broadcasts on VHF &amp; Inmarsat &quot;C&quot;. Also, Nav. Warnings &amp; Wx information from Navtex to be monitored.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>4.</td>
<td>Where harbour not fully protected, Duty Officer to check weather forecasts with Terminal every 2 hrs, if available.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>5.</td>
<td>Wind sock to be mounted on foremast, when it is suspected wind forces might pick up, to gauge any increase in wind velocity, from CCR.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Duty Officer to tend to moorings &amp; gangway regularly, under C/O's supervision from CCR. Deck watch to be used, &amp; any signs of wind or current at the berth preventing vessel from staying alongside to be reported to CCR &amp; Master immediately. On C/O's instructions, all vessel's extra mooring lines (3 ropes fwd + 3 aft) to be made fast to berth. If shore mooring crew unavailable, ship's crew to be sent onto jetty to make fast lines.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>In case of excessive wind speed, with signs of it increasing further, and/or if lightning present in the vicinity, and/or if it becomes increasingly difficult to keep the vessel alongside due to strong current, Terminal to be informed, &amp; cargo operations to be suspended. Mast Riser, if loading, to be shut. Engines to be put on standby. Port Authorities to be informed that Pilot &amp; tugs may be required.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>When cargo operations suspended, shut manifolds &amp; with Terminal assistance, if available, disconnect hoses/loading arms (except in case of lightning, with no weather deterioration).</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>In case of rapid deterioration of weather conditions, Port Authorities to be told to arrange tugs immediately, to keep vessel alongside the berth during cargo stoppage &amp; hose disconnection. Also, Pilot to be asked to board vessel without delay, in case it becomes necessary to cast off the berth.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10.</td>
<td>Full crew to proceed to unmooring stations immediately following hose disconnection, &amp; standby for orders from Bridge to cast off. C/O to distribute cargo/ballast to reach a seagoing condition as soon as possible.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>In the event that the weather shows no signs of improving, &amp; staying alongside is not a safe option for the vessel, vessel to cast off on Master's orders, in consultation with Port Authorities and proceed to a safe anchorage area, or steam well clear of any coastal hazards.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>WSM / Owners / Charterers are to be informed if, as and when required</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**Chief Officer**

**Chief Engineer**

**2nd Officer**

**Pumpman**

**3rd Officer**

**Bosun**

**Master**
### CHECKLIST NO. 6 - COLD-WEATHER CHECKLIST
*(PRIOR ENTERING WINTER ZONE)*

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>* Carry out greasing operation on wires, winches open gears, operating handles and clutches, hatch covers securing device and lashing materials.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>* Ensure the condition (seized/clogged free) of all lines and valves, such as hydrant, drains FW and air on deck.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>3.</td>
<td>* Sufficient stocks of anti-freeze, salts, snow shovel, mallet and crew winter clothing is available</td>
<td></td>
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<tr>
<td>4.</td>
<td>All fire main / Foam lines, anchor wash and hydrant should be drained and left open.</td>
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<tr>
<td>5.</td>
<td>Shut all FW lines to main deck and outside the accommodation and leave the faucet open.</td>
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<td></td>
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<tr>
<td>6.</td>
<td>Drain the Bridge windows wash water line and leave drain open, never attempt to open on sub-freezing temperatures.</td>
<td></td>
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<tr>
<td>7.</td>
<td>Ensure anti freeze is added in Life boat engines / Emergency generator cooling water</td>
<td></td>
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<tr>
<td>8.</td>
<td>Ensure Deepwell pump hydraulic system is operated at intermittent intervals to keep the oil warm and monitor the oil temperatures</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9.</td>
<td>All exposed Pneumatic/Electric motors for provision cranes and gangways are covered with canvass and being warmed up and tested prior arrival or use.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Ensure all mooring rope on drums and on deck are fully covered prior or after each berthing.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Ensure that the movable parts of the following are covered with grease mix with anti freeze such as manholes butterfly nuts, vents spindles, sounding pipes, hydrant wheel spindles, gangway and davit pivots, guide rollers and securing bolts, etc.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Ensure both sides pilot access, steps, gangway space, main access from ship to shore, main deck for cargo operation are clear of ice/snow and sprinkled with salts.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Ensure anti freeze is in proper proportion as required by ship specific PV breaker</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>14.</td>
<td>Ensure heating system on bridge windows and clear view screen remain on at all times.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>15.</td>
<td>Ensure all signal halyard are slack.</td>
<td></td>
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<tr>
<td>16.</td>
<td>Ensure all radar scanners are rotating at all times.</td>
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<tr>
<td>17.</td>
<td>Ensure all ballast air pipes and vents are clear and open prior ballasting and de-ballasting.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>18.</td>
<td>Ensure regular checks on PV Relief valves and High velocity vents as it is possible that humid air vented from cargo tanks may condense and freeze on gauge screens thus inhibiting ventilation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Ensure steam lines are properly drained and drains kept open and steam tracer lines are operable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO.</td>
<td>DESCRIPTION</td>
<td>YES</td>
<td>NO</td>
<td>N/A</td>
</tr>
<tr>
<td>-----</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>20.</td>
<td>Ensure that if Nitrogen is used for Padding then the pressure of Nitrogen is maintained</td>
<td></td>
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</tr>
<tr>
<td>21.</td>
<td>Depending on the cargo ensure that all PV valves, Tank domes, Butterworth openings are covered with canvas so that moisture does not spoil the cargo</td>
<td></td>
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<tr>
<td>22.</td>
<td>Ensure Air driven pumps and deck compressors if provided are in working condition and adequately warmed up</td>
<td></td>
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</tr>
<tr>
<td>23.</td>
<td>Ensure Air whistles are in operating condition and heating system in working condition</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>24.</td>
<td>Ensure Navigating lights are not obscured due to presence of Ice</td>
<td></td>
<td></td>
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<tr>
<td>25.</td>
<td>Ensure Sea water intake is closely monitored, particularly in Fresh or nearly Dock water and the steam blow lines to the sea chest are clear and working.</td>
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<td></td>
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</tr>
<tr>
<td>26.</td>
<td>Ensure Eye shower lines are drained properly and drains kept open and if heaters provided for the same, ensure they are operable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27.</td>
<td>Ensure salt and fresh water systems are drained completely when inert gas system is not required for operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28.</td>
<td>Ensure if heating coils present then they are drained and blown through with compressed air if not in use</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>29.</td>
<td>Ensure if vessel has river water ballast then it is interchanged with SW prior entering cold weather area</td>
<td></td>
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<tr>
<td>30.</td>
<td>Ensure AC plant heating is in good working condition</td>
<td></td>
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<tr>
<td>31.</td>
<td>Ensure cooling water of AC overboard recirculating valve is operable</td>
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</tr>
<tr>
<td>32.</td>
<td>Ensure Bilge high water level alarms are tested periodically</td>
<td></td>
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</tr>
<tr>
<td>33.</td>
<td>One steering motor to be kept running continuously, even when alongside.</td>
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</tr>
<tr>
<td>34.</td>
<td>Reduce E/Rm ventilation to minimum requirement, to cut down on cold air ingress.</td>
<td></td>
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</tr>
<tr>
<td>35.</td>
<td>All Fresh water tanks to be filled to no more than 90%, to avoid structural damage in case of freezing.</td>
<td></td>
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</tr>
<tr>
<td>36.</td>
<td>Heating on for Emergency Generator Room, Diesel tank to be no more than 90% full.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37.</td>
<td>Mooring winch/windlass hydraulic motors to be started &amp; kept running, from 24 hrs prior entry into sub-zero zone till 24 hrs after departure from same zone. Keep winches on slow turning from approx. 6 hrs prior arrival port.</td>
<td></td>
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</tr>
</tbody>
</table>

Duty Officer ___________________  Verified by Master ___________________
### CHECKLIST NO. 7 - CONTINGENCY PLANNING FOR STS OPERATIONS

**VESSEL NAME:**

**PORT:**

**DATE:**

**Note:** The Plan should be exchanged with 'other' vessel and filed with STS Checklists. It is vital this plan is exchanged if a Mooring Master is NOT in-charge of the operation.

<table>
<thead>
<tr>
<th>S.No</th>
<th>PLANNING ITEM</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Is a Mooring Master present for the STS operation?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 2.   | The Mooring Master is to be consulted when a decision is to be made to abort operations?  
Note: “The Master remains responsible for safety of own vessel and MUST keep eye on weather and any other special prevalent Criteria”. | | | |
| 3.   | How will decision to abort taken by Master of either vessel be communicated to the other vessel?  
VHF Ch: ________ | | | |
| 4.   | Emergency signal is to be decided between both vessels | | | |
| 5.   | Is the STS operation to be conducted in restricted waters? | | | |
| 6.   | If item 4 above “Yes” - are engines placed on short notice? How many minutes?  
MVsl: _________________________  
DVsl: _________________________ | | | |
| 7.   | Will the STS operation be carried out with vessels adrift or Mother vessel anchored?  
ADrift / Anchored | | | |
| 8.   | Is the bridge of Mother vessel to be manned during STS? If not with what frequency is the anchor position to be verified? | | | |
| 9.   | Is the bridge of daughter vessel to be manned during STS? If not with what frequency is the anchor position to be verified?  
Minutes: ________ | | | |
| 10.  | At what Wind force will operations be aborted? | | | |
| 11.  | At what Swell Height will operations be aborted? | | | |
| 12.  | If aborting operations, onto which vessel will the hoses be landed after draining?  
Stand-by boat:  
Mother: _________________________  
Daughter: _________________________ | | | |
| 13.  | If in restricted waters is it intended to proceed to sea after aborting STS operations? | | | |
| 14.  | Stand-by boat is to be informed in case of any contingency | | | |
| 15.  | SMPEP / VRP / QI notifications are to be carried out if, as and when required | | | |

**Signature:**

**Signature:**

**MASTER**  
Mother Vessel

**m.t.**

**MASTER**  
Daughter Vessel

**m.t.**
CHECK LIST NO. 8 – DURING LOADING / DISCHARGING OPERATION (HAZARDOUS CARGO)

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Is the vessel securely moored?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Is the condition of mooring ropes checked continuously by OOW and Deck watch?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Does the gangways have a free access and checked continuously by OOW and Deck watch?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Are deck lights ON during dark hours and flags Lowered?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Is the Gas detecting equipment in Ballast Pump Room ON?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Is the Safety / Firefighting equipment ready for immediately use?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Is there any sign of lightening. (If Yes cargo operation to be stopped immediately)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Is weather being monitored?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Are the Hi and Hi-Hi level Alarms ON?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Is the vessel with acceptable stability and stress?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Is the Deck Watch being maintained?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Are the Manifold and Pump pressures continuously monitored?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Is the pressure and temperature in the cargo tanks continuously monitored?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Is the Deballasting / Ballasting in accordance with Loading/Discharge Plan?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Are the cargo(s) being Loaded/discharged in accordance with Loading/Discharge Plan?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Is the Loading/discharging Rate calculating hourly?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Is the UTI/Sampler earthed (bonding) if ullages/samples being taken</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Are regular rounds being taken for any cargo leaks on Deck and Pump Stacks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are Security Patrols being carried out regularly</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE: ABOVE CHECKS TO BE CARRIED OUT EVERY FOUR HOURS.

Chief Officer

2nd Officer

CHECKED BY MASTER

3rd Officer

Master
APPENDIX 3 (A) - BUNKER TRANSFER PROCEDURES

1.0 BUNKERING TRANSFER PROCEDURES

The guidelines noted hereunder refer to any procedure which involves the transfer of fuel oil, diesel oil or lubricating oil to and from ship or from one tank to another and not considered as cargo.

1.1 PERSONNEL AND THEIR DUTIES

1.1.1. OVERALL IN CHARGE - CHIEF ENGINEER

Undertakes overall charge of procedure and is responsible for carrying out the task in proper manner, allocate related duties to other persons on board and oversee their work. Entire operation can be broken down in to following steps.

1.1.1.1. Determination of the amount of oil that the ship can take and order it through the Owners or Charterers. Accurate description and specification of the bunkers must be provided to the company arranging bunkers.

1.1.1.2. Preparation of the bunkering plan.

1.1.1.3. Establishment of the bunkering organisation and allocation of related duties to other staff.

1.1.1.4. Verification of preparations and safety precautions.

1.1.1.5. Liaison with bunker suppliers.

1.1.1.6. Supervision of testing of samples at the start of and during the bunkering operation and overall guidance and control.

1.1.1.7. MSDS to be obtained for each bunker

1.1.2. ASSISTANT TO CHIEF ENGINEER - BUNKER OFFICER (3RD OR 4TH ENG. AS NOMINATED BY C/E).

Undertake the following duties: -

1.1.2.1. Supervision of overall bunker operation including the preparation, bunkering work & post bunkering restoration work giving detailed instruction to workers.
1.1.2.2. Liaison with bunker barges.
1.1.2.3. Taking sounding. Also, bunker barge initial and final soundings/ullage of all tanks and acknowledgement taken of this from barge Master.
1.1.2.4. Checking on oil Specific Gravity & calculation of amount of oil received.
1.1.2.5. Checks on ships heel and trim.
1.1.2.6. Watch keeping on oil spillage.
1.1.2.7. Verification and reporting of the completion of bunkering operation.
1.1.2.8. Make entry in the checklist.

1.1.3. ASSISTANT TO BUNKERING OFFICER (TWO ER RATINGS)

Undertake the following duties under supervision of bunkering officer:

1.1.3.1. Check Air Vent for flow of Air
1.1.3.2. Arrangement of empty trays for receiving leaked oil.
1.1.3.3. Preparation of equipment & materials.
1.1.3.4. Open/Close operation of valves under instruction only.
1.1.3.5. Maintain watch on oil spill/leaks.
1.1.3.6. Pre and Post bunkering restoration work.

1.1.4. SPARE MEN - AS DESIGNATED BY CHIEF ENGINEER

1.1.4.1. As situation demands. Assisting in preparation for bunkering operation, post bunkering restoration work.
1.1.4.2. To provide back up assistance in emergency situation.

1.1.5. DECK DEPARTMENT - PERSONNEL SHOULD ENGAGE IN THE FOLLOWING ITEMS OF WORK TO ASSIST IN THE BUNKERING OPERATION.

1.1.5.1. Mooring/Unmooring operation of oil supply barges.
1.1.5.2. Checking the mooring condition of the ship during bunker operations.
1.1.5.3. Preparation of fenders and pilot ladders etc.
1.1.5.4. Verification of ships draft, trim and heel.
1.1.5.5. Closing and opening of deck scuppers.
1.1.5.6. Arrangements for flying/posting signal flags or lights.
1.1.5.7. Watch keeping for possible spillage accidents on board the ship as well as on the surface in the vicinity of the ship.
1.2. INFORMATION

Following items to be displayed prominently near the transfer facility and must be in large bold letters.
1.2.1. Ships bunkering pipeline diagram to be displayed.
1.2.2. Oil tank layout with associated vent piping.
1.2.3. Tank capacities full/98%/95%/90%
1.2.4. Product description: GENERIC NAME

FUEL OIL - PHYSICAL PROPERTIES:

Viscosity :
Sp. Gravity :
Flash Point :
Colour : Black
Odour : Strong Aromatic

DIESEL OIL - : Details as above.
LUBRICATING OIL - : Details as above.

1.2.5. PRODUCT HANDLING PRECAUTION

The products are non-toxic. In very rare cases can cause allergic reaction to skin. Avoid body contact. Wear impervious gloves. If oil gets into eyes, wash with fresh water for 15 minutes and seek medical help. REFER TO MATERIAL SAFETY DATA SHEET (MSDS)

1.2.6. PRESSURE TESTING OF BUNKER PIPE LINES

Bunker line to be pressure tested to its working pressure annually onboard for vessels less than 20 years old. For vessels more than 20 years old, bunker lines are to be pressure tested to its working pressure once in six months on board. Twice in 5 years, in Dry Dock, it should be tested to 1.5 times of the design pressure.

The working pressure should not be mixed up with the design pressure mentioned in the piping diagram booklet. Initially, the working pressure maybe established by checking last 10 or 15 bunker plan where in rate and pressure at which bunker is taken is mentioned. The average higher pressure from this plan should be taken. This will be the established working pressure which should be stenciled on the bunker line on deck near the manifold valve. Annual testing onboard should be done to this pressure.

The pressure testing of the line should be done by the F.O. transfer pump. In some cases, the pump relief valve may have to be adjusted to a higher value to be able to achieve the testing pressure on deck. In such event, the setting
should be adjusted back to its normal value after the test. Before setting to higher pressure, the pump specification should be checked so that relief valve is not adjusted above that value.

In case, the transfer pump is not capable of delivering up to the test pressure, bunker line should be filled up by the F.O transfer pump first and then a hand pump or similar such pump should be used to build up the pressure.

Testing pressure and date should be stenciled on the bunker line.

1.3. PRECAUTIONS

Utmost care and vigilance must be exercised while carrying out the bunkering or transfer operations. Following guidelines must be strictly adhered to during operations to avoid any spillage.

1.3.1. Prepare the oil receiving plan in advance taking into account the trim/list are accurately accounted for in calculation of quantities in various tanks. Refer to sample in Section 5.7 of this manual.

1.3.2. Bunkering Checklist and the Bunkering Safety Checklist in ship type specific manual is to be complied with and completed. Any additional ship specific item can be included by hand in the bunkering checklist in the ship type specific manual.

1.3.3.1 Bunkering Safety checklist to be signed both by C/Eng and bunker barge/terminal in-charge. The Safety checklist to be used for loading bunkers from barge, when taking bunkers from Jetty or when loading bulk lubricating oil or gas oil from road tanker and is to use in all such cases.

1.3.3.2 All tanks on barge to be sounded and / or flowmeter noted.

1.3.3.3 Proper signal/lights for bunkering posted.

1.3.3.4 Line for bunkering to be set and double-checked. Final soundings agree and bunker team advised. (DB Tanks to not exceed 90% capacity). Unauthorised personnel not to touch valves.

1.3.3.5 Valves in system not in use to be kept shut. Other filling connections to be kept blanked.

1.3.3.6 Ensure O/flow tanks are empty prior beginning operation. Special attention must be paid in this regard in vessels fitted with the ring main/pressure relief systems. O/flow tanks to be sounded at regular intervals and action taken accordingly.

1.3.3.7 Start transfer slowly and once pipe lines attain the temperature of supplied oil, increase rate to the agreed value. Watch the pressure gauge at the bunker manifold closely.

1.3.3.8 Maintain record of the filling rate at all times.

1.3.3.9 Ensure sounding in tanks not being filled are remaining same.
1.3.3.10 Check sample for correct viscosity, density and flash point. Any abnormal values to be reported/protested to safeguard interest.

1.3.3.11 Exercise caution when changing over tanks. Open fully the valve of the tank to be filled then close the valve of the filled tank slowly.

1.3.3.12 Check the line pressure at all times against system over pressure.

1.3.3.13 Reduce rate to safe amount while topping up. Top up one tank at a time.

1.3.3.14 Adjust mooring lines during operations.

1.3.3.15 Check ships trim and list condition and maintain in a steady condition.

1.3.3.16 Maintain watch on board for oil spill /leaks.

1.3.3.17 End of transfer:-

   i) Exercise caution when blowing through lines especially if the tank are full especially if the tanks are full to prevent oil spilling from vents.

   ii) Secure all valves prior to disconnecting hoses

   iii) Fit necessary blank flanges

   iv) Check final sounding

   v) Clean up containment trays and put back all materials in store.

1.3.3.18 In case of doubt/difficulty, cease transfer till problem resolved and it is safe to continue.

1.4. **POLLUTION CONTROL**

In case of accidental spillage and pollution.

1.4.1. Inform authorities concerned without delay.

1.4.2. Endeavour utmost to minimise spill overboard.

1.4.3. Assist in the clean up operation.

1.4.4. No chemicals to be sprayed on water unless authorised by the local authorities.

1.5. **QUALITY AND QUANTITY CONTROL**

1.5.1. It has happened that the specific gravity of bunkers being supplied are marginally less than the figures given in the delivery note. The difference may not appear to be large but when the weight of bunker is calculated by using two different Sp. gravities the difference can be significant. Since cost of bunker is based on the weight the price differential can be quite large. Therefore care must be given to
checking correct sp. gravity and if difference is noted then it must be brought to the attention of the supplier.

1.5.2. In case of such disputes the bunker sample is to be analysed by an independent laboratory. For this purpose proper samples must be taken from the bunker line in presence of the supplier and sealed with his signature.

1.5.3. Importance of viscosity is well known. Sample taken from the line should be immediately analysed to check if viscosity is same as ordered. Small difference, say about 20 CST, can be acceptable. But if the difference is large then it cannot be ignored and must be brought to the attention of the supplier.

1.5.4. There have been incidents when the difference was found to be quite large and the ship had stopped bunkering. The supplier then admitted their mistake and changed the supply. However in such situation pleased ensure that your testing equipment and procedure are absolutely trustworthy.

1.5.5 With the impact of environmental legislation and awareness, the nature of MDO or HFO contamination is changing. Recently a vessel bunkering from a barge received HFO with a Flash Point dangerously below the 60°C minimum required by Class and SOLAS Chapter II-2, Reg. 15. If there is any doubt on this account it would be prudent to ensure proper custody transfer sampling is done, sent for analysis and bunker not used until analysis received.

1.5.6 Where available tank space makes it possible, bunkers are not to be mixed (old & new). When bunkers are mixed, a sample with the ratio as in the tank to be sent for analysis. The mixed bunkers are not to be used until analysis is received.

1.5.7 Bunker samples during bunkering is to be taken with Drip sampler only. This is a requirement as per IAPP and vessels are to comply with procedures and requirements of Marpol Annex VI.

1.5.8 Vessels are to be aware of ECA areas where only Low Sulphur fuel and diesel is to be used. Ship specific Procedures as per IAPP for changing over to Low sulphur fuel and diesel to be complied with as per ship specific Procedure which have been prepared after discussions between vessels superintendent and the Vessel.

1.5.9 Vessels to be guided by the following for Maximum % capacity that is to be filled for Bunkers:
   a) For DB Tanks, the DB tank percentage is not to exceed 85%. When “Full Bunkers” are to be taken, then, 90% is acceptable, however with slower pumping rate and due caution.
b) For shoulder or Deep tank, the recommended fill percentage is 95%. This fill percentage can be increase to 98% on a case-by-case basis in consultation with WALLEM when “Full” bunkers are to be taken.

1.5.10 Tankers are to check the vapour space of the bunker tank prior to, during and after bunkering. If H2s is detected, the bunker tank should be periodically tested during voyage and precautions taken as required for avoiding personal exposure to H2S.

1.6 DURING THE VOYAGE

Bunker tanks sounding must be physically checked by a responsible ship’s engineer and records of quantities maintained.

This physical check of bunker tank soundings must be made at least twice every week, before arrival port and before and after bunkering. Do not rely on flow meters for calculating quantities of bunkers on board.

Soundings of all fuel oil and diesel oil bunker tanks must be taken by a responsible ship's engineer and recorded in the Engine Log book twice per week whilst at sea, at end of voyage, prior to departure and when in sheltered waters at anchor. Please note that this does NOT refer to Sludge tanks as mention in Appendix to IOPP certificate.

If the voyage is less than three days then soundings are to be taken at the end of voyage and prior to departure only.

The Fuel ROB figures are to be calculated by the Chief Engineer using these soundings and the vessels' calibration tables. Temperature corrections, correct S.G. from bunker receipt and trim and heel corrections must be used in these calculations.

These figures are to be presented to the Master for his reference.

1.7 BUNKER ANALYSIS REPORT

Upon receipt of bunker analysis report C/E must discuss same with entire Engine Team and issue instructions for separator setting, temperature setting and service/settling tank draining requirement and logged down.
BUNKERING SAFETY CHECKLIST

<table>
<thead>
<tr>
<th>Port</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ship</th>
<th>Barge</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Master</th>
<th>Master</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

1. Bunkers to be Transferred

<table>
<thead>
<tr>
<th>Grade</th>
<th>Tonnes</th>
<th>Volume at Loading Temp</th>
<th>Loading Temperature</th>
<th>Maximum Transfer Rate</th>
<th>Maximum Line Pressure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fuel Oil</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gas Oil / Diesel</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lub. Oil in Bulk</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

2. Bunker Tanks to be Loaded

<table>
<thead>
<tr>
<th>Tank No.</th>
<th>Grade</th>
<th>Volume of Tank @____%</th>
<th>Vol. of Oil in Tank before Loading</th>
<th>Available Volume</th>
<th>Volume to be loaded</th>
<th>Total Volumes Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

3. Checks by Barge Prior to Berthing

<table>
<thead>
<tr>
<th>Bunkering</th>
<th>Ship</th>
<th>Barge</th>
<th>Code</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The barge has obtained the necessary permissions to go alongside receiving ship.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>The fenders have been checked, are in good order and there is no possibility of metal to metal contact.</td>
<td></td>
<td></td>
<td></td>
<td>R</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adequate electrical insulating means are in place in the barge-to-ship connection.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>All bunker hoses are in good condition and are appropriate for the service intended.</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bunkering</td>
<td>Ship</td>
<td>Barge</td>
<td>Code</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
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<td>-------</td>
<td>------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>5. The barge is securely moored.(2)</td>
<td></td>
<td></td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>6. There is a safe means of access between the ship and barge.(1)</td>
<td></td>
<td></td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>7. Effective communications have been established between Responsible Officers.(3)</td>
<td>A R</td>
<td></td>
<td>(VHF/UHF Ch ...........), Primary System: Backup System: Emergency Stop Signal.</td>
<td></td>
</tr>
<tr>
<td>8. There is an effective watch on board the barge and on the ship receiving bunkers.(22)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>9. Fire hoses and fire-fighting equipment on board the barge and ship are ready for immediate use.(5)</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10. All scuppers are effectively plugged. Temporarily removed scupper plugs will be monitored at all times. Drip trays are in position on decks around connections and bunker tank vents. (10) (11)</td>
<td></td>
<td></td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>11. Initial line up has been checked and unused bunker connections are blanked and fully bolted.(13)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. The transfer hose is properly rigged and fully bolted and secured to manifolds on ship and barge.(7)</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>13. Overboard valves connected to the cargo system, engine room bilges and bunker lines are closed and sealed.(16)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. All cargo and bunker tank hatch lids are closed.(15)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Bunker tank contents will be monitored at regular intervals.</td>
<td>A R</td>
<td></td>
<td></td>
<td>at intervals not exceeding…….minutes</td>
</tr>
<tr>
<td>16. There is a supply of oil spill clean-up material readily available for immediate use.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. The main radio transmitter aerials are earthed and radars are switched off. (42)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Fixed VHF/UHF transceivers and AIS equipment are on the correct power mode or switched off.(40)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19. Smoking rooms have been identified and smoking restrictions are being observed.(36)</td>
<td>A R</td>
<td></td>
<td></td>
<td>Nominated Smoking Rooms Ship/Tanker: Barge:</td>
</tr>
</tbody>
</table>
20. Naked light regulations are being observed.(37)  

4. Checks Prior to Transfer

<table>
<thead>
<tr>
<th>Bunkering</th>
<th>Ship</th>
<th>Barge</th>
<th>Code</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. All external doors and ports in the accommodation are closed.(17)</td>
<td></td>
<td></td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>2. Material Safety Data Sheets (MSDS) for the bunker transfer have been exchanged (26)</td>
<td></td>
<td></td>
<td>R</td>
<td></td>
</tr>
<tr>
<td>3. The hazards associated with toxic substances in the bunkers being handled have been identified and understood.(27)</td>
<td></td>
<td></td>
<td>R</td>
<td>H₂S Content .......... Benzene Content ......</td>
</tr>
</tbody>
</table>
DECLARATION

We have checked, where appropriate jointly, the items of the Check-List in accordance with the instructions and have satisfied ourselves that the entries we have made are correct to the best of our knowledge.
We have also made arrangements to carry out repetitive checks as necessary and agreed that those items coded ‘R’ in the Check-List should be re-checked at intervals not exceeding _____ hours.

If, to our knowledge, the status of any item changes, we will immediately inform the other party.

<table>
<thead>
<tr>
<th>For Ship</th>
<th>For Barge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Name</td>
</tr>
<tr>
<td>Rank</td>
<td>Rank</td>
</tr>
<tr>
<td>Signature</td>
<td>Signature</td>
</tr>
<tr>
<td>Date</td>
<td>Date</td>
</tr>
<tr>
<td>Time</td>
<td>Time</td>
</tr>
</tbody>
</table>

Record of repetitive checks:

| Date: | | |
|-------| | |
| Time: | | |
| Initials for Ship: | | |
| Initials for Barge: | | |
## APPENDIX 3(B) - BUNKER CHECKLISTS

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>A) PRE-BUNKERING CHECKLIST</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>Pre bunkering training completed.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td><strong>Oil receiving plan made and kept ready.</strong></td>
<td></td>
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</tr>
<tr>
<td>2.</td>
<td>Declaration of inspection signed by P.I.C. (applicable in U.S. waters)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Access to/from bunker barge is safe &amp; adequately lighted. Bunker manifolds are well lit.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Bunker transfer line diagram to be placed on the manifold</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Pre transfer conference held with person in charge of bunkering barge/ facility covering the following:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>A. Bunker to be supplied meets vessels specifications.</td>
<td></td>
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</tr>
<tr>
<td></td>
<td>B. Sequence of Grades to be supplied given to barge in writing.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>C. Pumping rate agreed ( in writing )</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>D. At commencement Mt/hr.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>E. Maximum during bunkering Mt/hr</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>F. At topping off/ completion stage Mt/hr.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>G. Emergency stop procedures agreed in writing.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>H. Communication methods by hand signals agreed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>I. Check approval cert. for bunker hose with barge. If unavailable give letter of protest.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Suppliers own emergency procedure discussed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>J. Ship’s officer responsible for communications with bunker barge is introduced to bunker barge representative.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>K. Check barge has approved sounding tables. If not, give letter of protest.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>L. Collect <strong>MSDS</strong> sheet from the supplier. If supplier does not provide <strong>MSDS</strong> sheet then give letter of protest.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Consult with barge Master and agree on sampling location. Place ship’s representative on the sampling point to ensure continuous and drip sampling till the bunkering is completed and lines are flushed.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>As per MARPOL, ship’s manifold is the designated bunker sampling point, hence 4 samples (3 + MARPOL sample) are still to be collected at ship’s manifold.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Ask supplier to provide a copy of BDN to checks specs and also copies of MSDS for display on vessel and for placing with sample for lab analysis.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>All product handling precautions to be taken as per MSDS.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Ensure valves shut prior removing manifold blanks. Fit sampling equipment.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td><strong>Supplier’s Pre delivery oil tanks ullages checked, noted and oil quantity calculated.</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Check that line-up is correct. The line-up is to be checked by 2 persons independently</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14.</td>
<td>Establish emergency means of communication between wheel house and control station, which may be ECR or an individual platform.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>‘B’ flag raised or switched on red light on mast.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16.</td>
<td>Oil spill kit contents to be checked and kept standby- near bunker manifold.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17.</td>
<td>Confirmed from Duty Officer all scuppers are blocked.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Save-all- empty and plugged.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### Bunker Checklist

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.</td>
<td>Inform Master that bunkering is about to commence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20.</td>
<td>Unused manifold connections are blanked off.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.</td>
<td>Check all bunker tank air pipes are open and unblocked.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23.</td>
<td>Time bunkering started hrs. Informed Duty Officer.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

This section of checklist is completed on __________________ at __________________ Hrs

By __________________

Note: Bunkering Safety Checklist between the Bunker barge/shore and ship from the Safety Manual is to be completed.

### B) DURING BUNKERING / TOPPING OFF PROCEDURE

1. Commence at minimum pumping rate.
2. Monitor bunker line pressure.
3. Examine hose connections bunker flanges not in use for leakage. Check that oil is only going to the required tanks. Check soundings of all tanks to confirm.
4. Attain steady pumping rate after ensuring oil flowing only to designated tanks.
5. Commence continuous drip sampling at manifold.
6. The ullages / Soundings in the tanks to be checked at regular intervals to ensure that bunkers are being received at the agreed pumping rate.
7. If possible, a standby tank having enough space to be always kept for opening in emergencies. (This may be the overflow tank).
8. The level in the tanks to be staggered so that only one tank is topped up.
9. One person must be standby at manifold at all times.
10. Communications with the barge must be checked at regular intervals especially, prior critical operations like topping of tanks.
11. The bunker barge and deck watch must be informed before topping off and/ or changing over tanks.
12. Reduce pumping rate and / or open next tank prior topping off.
13. Close valves as each tank is completed.
14. Deck Watch-Keeper to ensure no spill on deck & constantly, monitor moorings
15. Ensure sufficient Ullage space available in final tank for line blowing.
16. Record time of completion and close all filling valves after blow through.

TIME: ____________

This section of checklist is completed on __________________ at __________________ Hrs

By __________________

### POST BUNKERING CHECKLIST

1. Ensure all hoses are fully drained.
2. Close and blank all manifold connections.
3. Blank the bunker barge hose connection.
4. Sound all tanks and calculate oil-received taking into consideration list, trim & temperature.
5. Note soundings / meter readings and temperatures of tanks of supply barge. Work out the quantity supplied and keep record to reconfirm quantity received.
6. Verified all bunker receipt details are correct and in compliance with MARPOL Annex VI. In case of any disputes, regarding quantity/quality/give appropriate letters of protest and inform all parties immediately.
7. On completion of sampling the seal to be broken in the presence of all concerned and the cubitainer to be capped
8. Contents of each cubitainer to be thoroughly shaken to homogenize the mixture and the 3 nos. sample bottle to fill till the specified mark.
<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.</td>
<td>The 3 nos. sample bottles to seal, each seal number to have necessary documentation. There will be an additional bottle for MARPOL sample, which should not be less than 1 L capacity. All bottles should have identification stickers and seals and stickers to be jointly signed by barge rep and C/E. One bottle to send to fuel testing laboratory, one to be given to the supplier's representative and one bottle to be kept on board. The samples to be sealed and signed by the supplier’s representative and the vessel’s representative (i.e. Chief Engineer).</td>
</tr>
<tr>
<td>10.</td>
<td>The retained sample should have following minimum information on the tag: - Location and method of sampling. 1. Date of commencement of delivery. 2. Name of bunker tanker/installation. 3. Name and IMO number of receiving ship. 4. Signatures and names of supplier’s representative and ship’s representatives. 5. Details of seal identification and Grade of bunker received</td>
</tr>
<tr>
<td>11.</td>
<td>The bunker delivery note to be retained on board for a minimum period of 3 years from the date of bunker-delivery.</td>
</tr>
<tr>
<td>12.</td>
<td>MARPOL sample bottle to be retained on vessel for at least 1 year or till oil is used, which ever is later.</td>
</tr>
<tr>
<td>13.</td>
<td>When in, or heading for, cold area: In order to avoid “freezing”, ensure the bunker line is thoroughly drained after bunkering. Also ensure that the bunker line on deck is not filled up with bunker when making transfers, and the valve/s to deck is/are left open by mistake.</td>
</tr>
<tr>
<td>14.</td>
<td><strong>STORING OF RETAINED SAMPLE BOTTLE</strong> 1. The retained sample should be kept in a safe storage location. 2. The retained sample must be stored for 12 months minimum from date of delivery.</td>
</tr>
<tr>
<td>15.</td>
<td>Update Oil Record Book.</td>
</tr>
<tr>
<td>16.</td>
<td>Land sample for analysis to fuel testing laboratory</td>
</tr>
</tbody>
</table>

**Procedures for Reporting Discharges of Oil or Hazardous Material in the Water:**

A. Any person observing any oil or hazardous material discharge in the sea shall immediately report to the Master and Chief Engineer immediately.

B. The Master to follow reporting procedures as per SMPEP / VRP
APPENDIX 4 (A) - ENGINE ROOM PROCEDURES

1. GENERAL

Please refer to Sec 11 of SBM I
All vessels have detailed manufacturer's manual for various machinery in the Engine room. The manuals cover both operation of the machinery and their maintenance.

All Permits to work including Enclosed space entry and hot work permit are in the Safety manual and to be used as applicable.

When maintenance is being carried out on any equipment, the equipment must be isolated (Lock out & Tag out). Isolation permit in Safety Manual to be completed.

Appendix 3 of this Manual contains the Bunker transfer procedure and the Bunker transfer checklist.

Appendix 4 of this manual contains the Engine room checklists.

Sample of Chief Engineers standing orders and Instruction for calling Chief Engineer is provided in this section. Chief Engineer to draw up his own Standing order and have them signed by other Engineers and the posted.

Test routines of Emergency equipment are in the SMMS and are to be carried out as per the planned schedule.

All Joining engine room staff to be familiarised with the layout and equipment in the engine room by the outgoing staff or by an officer or crew designated by the Chief Engineer.

Blackout recovery procedure would be drawn up specific to the vessel and posted in the ECR.
2. **CHIEF ENGINEER’S STANDING ORDERS**

   (Sample- Each Chief Engineer to prepare his own standing orders)

- All Personnel entering the engine room shall be properly attired in full sleeve boiler suit, safety shoes, helmet and earmuffs/plugs.

- Smoking is only allowed in designated smoking area which for engine room is ECR.

- The machinery space is to be kept clean and tidy at all times. Cotton rags are to be disposed only into the covered drums kept for this purpose. All plastics are to be thrown into drum marked “Plastics only”.

- All tools are to be returned to their respective places after work. Good housekeeping practices are to be strictly followed.

- All special tools must be under the custody of 2/E and are to be returned to him after use.

- All personnel are to be familiar with their emergency stations and duties. They must also be familiar with the location and operation of LSA/FFA equipment.

- Safety Equipment under a particular engineer’s care must be checked every Saturday and any defects rectified immediately and brought to the notice of Chief Engineer.

- Engine room bilges are to be transferred to bilge holding tank, settled for at least 24hrs before being pumped overboard through 15 ppm oily water separator. The OWS is to be operated only under my supervision.

- No Hot work is to be carried out in the Engine room without obtaining a permit as per safety manual (chapter 19) except in the designated space (engine room workshop). The Chief engineer will authorize the hot work in the designated space (engine room workshop) and state the duration of permit for the day on a prominent notice at the work place. No hot work is allowed in the designated space (Engine room workshop) during bunkering operations.
• Various Operational checklists from Appendix 3B and Appendix 4B of this manual are available in ECR for identified critical operations. These checklists are to be filled by duty engineer whenever the particular operation is carried out.

• Jobs completed and spare parts consumed are to be entered in SMMS by individual engineers with their own “User-ID”. Appropriate history of the repairs is to also be entered in the SMMS.

• Any abnormality, defect or leakage is to be attended immediately and Chief Engineer informed.

• Duty engineer is to attend all alarms promptly and shall take regular rounds of machinery spaces.

• 2/E is delegated to be in charge of engine room personnel and strict discipline to be maintained at all times. All engineers are to carry out their duties diligently and sincerely.

• Any breakdown of equipment or systems is to be entered in the Defect list section of SMMS with date when the repairs are expected to be completed.

• Risk assessment to be carried out as per guidelines in the Risk assessment section of SBM II.

• MOC (Management of Change for vessel) is to be carried out when any equipment is replaced except for replacement in kind(RIK).

• All personnel are to ensure that high standards of “Safety, Operation & Maintenance” are in practice at all times.

• Presence of the Chief Engineer in Engine room or ECR does not relieve the duty engineer of his watchkeeping/other responsibilities.

• No adjustments to automatic control systems, controllers, actuations etc. to be done without the knowledge and permission of the Chief Engineer.

• For UMS vessels, a thorough round of the machinery spaces as per the UMS checklist is to be completed and bridge to be informed prior putting engine room on UMS mode.
2.1 INSTRUCTIONS FOR CALLING CHIEF ENGINEER (Sample)

Please inform Chief Engineer by phone in the event of the following:

- When in doubt about any variation in plant parameters.
- When two hours’ notice is received prior arrival/departure port/anchorag etc..
- At any time when Bridge requests for change of main engine revolutions.
- Any high or low pressure oil pipe leakage is detected.
- Any sea water pipe rupture or leakage is detected.
- Any abnormal noise or vibration is detected in any machinery.
- Breakdown/changeover of important machinery such as Boilers, Generators, Steering Gear pumps etc.
- Vessel’s PA system can be used to call Chief Engineer in case he is not available in the cabin.
3. **CONTROL OF HAZARDOUS MATERIAL USED ON BOARD**

1) It is company policy that all chemicals, paints, cleaning materials, etc. are handled and stored according to The International Maritime Dangerous Goods Code. The following are general guidelines but are no substitute for consulting the IMDG and makers product information.

2) All vessels will maintain a file containing hazard data sheets for various materials in use. MSDS must be maintained for the following:

   A. Engine Room chemicals
   B. Engine Room lubes and greases
   C. Paints and Thinners
   D. Domestic cleaning materials
   E. Tank cleaning materials
   F. Miscellaneous

Please refer to SHEQ Manual for asbestos free requirements.

3) Labelling:

   A. WSM being an ISO 14001 certified company only purchases products from standard manufacturers, as such all their products are properly marked. No chemical or hazardous material will be accepted on board without it being properly marked / labeled.

   B. The labels must be in good condition, clearly readable, with all proper hazardous warnings and markings in place. Any packaging not meeting these requirements should not be accepted on board.

   C. Drums brought on board by shipyards, contractors, or sub-contractors must comply with (B).

   D. On occasions vendors or contractors may supply equivalent tank cleaning chemicals or solvents in used
drums. In such situations the drums must not be accepted until they are correctly marked. When ordering chemicals at a port not holding a standard stock, it would be prudent to advise supplier in advance regarding marking of drums.

E. Empty drums used by ship for storage of liquids must have old labels erased and be remarked. Such drums must be thoroughly cleaned out from previous product to avoid any reaction between incompatible chemicals.

4) Storage:

These must be stored as per the IMDG regulations but following principles are general company policy.

A. Inflammable and Toxic materials must under no circumstances be stowed inside the accommodation. This includes large quantities of laboratory methanol, fuel samples, cargo samples, domestic cleaning materials.

B. Paint and thinners are to be stowed only in the approved paint locker equipped with fixed fire extinguishing system. Paints or thinners must never be stowed in steering compartment or machinery spaces. At the end of the working day they must be returned to the paint store.

C. Boiler Chemicals, E.R. Cleaning chemicals, Electrical cleaners. These are in general a mixture of toxic, corrosive or inflammable material. In some cases the chemicals may react with water or heat to give off toxic fumes and in others they could be inter-reactive.

D. Drummed Lubes. Only very small quantities of ready to use oil should be stowed near machinery.
E. Miscellaneous:

a) Read and follow the relevant MSDS sheets for any specific instructions.

b) Existing procedures for issue of chemicals are to be further intensified, maintained under strict control, and R.O.B. records maintained.

c) Chemicals will only be issued by the Officer responsible for its control. At no time is any crew member allowed to enter the chemical locker unaccompanied.

d) If drums are to be cut, then this must be done under direct supervision of a responsible officer, and procedures for ‘Hot work” strictly followed.

e) Prior to any such work being carried out ensure that empty drums are thoroughly rinsed, and drained, and atmosphere checked.

f) The plugs / caps are to be removed prior to starting any cutting.

g) Empty drums must be cleaned and rinsed prior to being stored, and the drum marked as being cleaned, with the caps open.

h) Record of inventory to be kept as per sample below
Vessel : ____________________________________________

Chemical Locker Inventory and Record for the month of ______________

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>FROM LAST INVENTORY</th>
<th>DELIVERED THIS MONTH</th>
<th>USED THIS MONTH</th>
<th>R.O.B. STOCK</th>
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</thead>
<tbody>
<tr>
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</tbody>
</table>

Remarks:
If any drums were emptied during the month, record of same to be mentioned below.

<table>
<thead>
<tr>
<th>Remarks:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
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<tr>
<td></td>
</tr>
</tbody>
</table>
4. ENGINE ROOM EMERGENCY PROCEDURES

4.1 SHIP SPECIFIC PROCEDURES

Ship specific procedures are to be drawn up and kept in a file in the Engine room. At a minimum, the following emergency procedures are to be included:

1. Measures in case of Black – Out (Black out recovery procedure shall be made and posted in the ECR). All Engineers have to be familiar with the Black-out recovery procedure.
2. Manual start of the Emergency Generator
3. Flooding of Engine Room – Vessel to also refer to Checklist 15 of Section V of MCCM.
4. Failure of cooling system for Main Engine and Auxillary Engines
   Any other emergencies can be included as applicable to the Engine room
5. Failure of Purifiers

4.2 MEASURES IN CASE OF FIRE IN ENGINE ROOM

In case Engine Room is manned, following procedure is to be followed by the person who notices the fire:

- Sound the fire alarm.
- Inform Bridge/ECR.

Fight the fire locally with available firefighting equipment. The below mentioned measures are taken when the fire is spread out and beyond control with available firefighting equipment in Engine Room platforms.

- Stop bunkering operations if in progress.
- Operate emergency stop switch for F.O. & L.O. pumps.
- Operate emergency stop switch for E/R fans.
- Operate quick closing valves as applicable.
• Emergency generator to be started if it has not already automatically started.
• Emergency fire pump to be started.
• Close all flaps; dampers and openings to the Engine Room.
• Proceed to the EHQ.

In case Engine room was unmanned, following action is to be taken:

• Duty engineer will first muster at the EHQ.
• Proceed as directed.
• Depending on the zone of the fire, entry should be made with full protective gear and charged hose from the most suitable entrance to the Engine Room.

Refer to Checklist 8 of Section V of MCCM. Checklist 8 also details the procedure for evacuation and total flooding in case the fire is out of control.
4.3 MEASURES IN CASE OF GROUNDING
(Specific to Engine room)

Grounding checklist is available as Checklist 3 and 4 in Section V of MCCM and is to be followed.

In case of grounding, following procedure is to be followed with reference to Engine room:

Main Engine is to be stopped if it has not already tripped. Change over to high sea suction.

Sound all double bottom tanks and cofferdam to assess any rupture of hull. Ensure that there is no changes of E/R bilge levels.

Main Engine to be inspected thoroughly. The following to be checked/tested:

- Holding down bolts and chocks.
- Crankshaft deflection.
- Mechanical control gear.
- Main bearing clearances.

- Intermediate shaft and its bearing to be checked.
- Stern tube system for possible leakage.
- Following to be done only after approval discussion with office
- Turn engine on turning gear. Observe T/Gear load (Amps) on panels after discussion with office. Check for any abnormal noise or vibration.
- Inspect Steering Gear. Check rudder movement to ascertain that no leakage of hyd. oil or distortion of rudder stock have taken place.
- Any attempt to refloat the vessel with the help of Main Engine must be out after ascertaining that no damage to engine, gearings and shafting caused due to grounding.
APPENDIX 4 (B) - ENGINE ROOM CHECKLIST

E/R CHECKLISTS NO. 1 - STEERING GEAR TEST .......................... Error! Bookmark not defined.
E/R CHECKLISTS NO. 2 - ARRIVAL PORT ................................. Error! Bookmark not defined.
E/R CHECKLISTS NO. 3 - DEPARTURE PORT ............................. Error! Bookmark not defined.
E/R CHECKLISTS NO. 4 - SHIFTING ........................................ Error! Bookmark not defined.
E/R CHECKLISTS NO. 5 - UMS OPERATION ............................... Error! Bookmark not defined.
E/R CHECKLISTS NO. 6 - AUXILIARY ENGINE START/STOP .......... Error! Bookmark not defined.
E/R CHECKLISTS NO. 1 - STEERING GEAR TEST

| VESSEL NAME | PORT | DATE |

N.B. USCG required tests conducted no more than 12 hours prior to entering/getting underway as per title 33 CFR Section 164.25.

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>ARR</th>
<th>DEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Primary/Secondary Steering</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Internal Vessel Control Communications and Alarms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Standby/Emergency Generator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Storage Battery/Emergency Lighting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Power system in vessel control &amp; propulsion machinery spaces</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Main propeller machinery, ahead &amp; astern</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>An emergency steering drill must be conducted within 48 hours unless the drill is conducted regularly once every 3 months</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

REMARK:

NOTE: All above tests should be entered in Deck & Engine Log Books. Failure to record tests in vessel’s log can cause delays and the potential for a US$25,000.- Civil Penalty as per USCG Rules Title 33 CFR Paragraph 164.11.

Duty Engineer

Chief Engineer
## E/R CHECKLISTS NO. 2 - ARRIVAL PORT

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>AT 1 HOUR NOTICE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Chief Engineer informed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Confirm required E/R staff at hand for <strong>maneuvering</strong> condition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Stop Fresh water generator and shut dosing system</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Change over sea suction to high if required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Second generator started and taken on load. Sump tank checked and all parameters normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Check Emergency and Standby generators are on Auto and ready for immediate use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Ensure all M/E parameters are normal for the set rpm and check sump tank</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>One Auxiliary Boiler brought up to working pressure and ready for use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Second Auxiliary Boiler pressed up and fully Isolated.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>10</td>
<td>Change over valves of Sewage Treatment Plant as required</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Check that all bilge wells are clean. Bilge water separator overboard valve closed and lashed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Main air compressors operational and in Auto mode</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Start air reservoirs pressed up and drained of water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Reserve air bottle pressed up and isolated</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Control air system, filters, water traps and accumulators drained of water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Check all non running pumps are selected on &quot;Stand-by&quot; as applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Power for both ICCP, FWD and AFT switched off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Daily / Header / Sump tanks (FO, MDO, LUB oil and FW tanks) levels checked and drained of water as applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Incinerator to be stopped and secured. All garbage segregated in designated drums and properly stored.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Workshop machineries, Welding and Gas cutting equipments properly secured, disconnected and isolated.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>All engine room access doors from deck secured from inside as per Marsec level.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Emergency air bottle pressed up to 30 bars and isolated.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Check Stern tube air guard system flow rate and oil tank pressure is normal</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**AT END OF PASSAGE (EOP)**
<table>
<thead>
<tr>
<th>NO.</th>
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<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>24</td>
<td>All Counters and Flow meters taken and recorded on Manoeuvring Book</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Main Engine tried out on fuel in both directions from Bridge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Steering gear checks carried out &amp; check list complied with.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>M/E Jacket cooling water pre-heating steam opened if required</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**AT FINISHED WITH ENGINE (FWE)**

| 28  | All Counters and Flow meters taken and recorded on Manoeuvring Book                                                                             |     |    |     |
| 29  | Auxiliary blowers off                                                                                                                           |     |    |     |
| 30  | Indicator cocks open. Turbocharger drains open                                                                                                |     |    |     |
| 31  | Fuel Oil Supply pump switched off                                                                                                               |     |    |     |
| 32  | Turning gear engaged. M/E turned at least one revolution on turning gear after propeller clearance is given from Bridge.                       |     |    |     |
| 33  | M/E Jacket cooling water pre-heating steam opened.                                                                                                |     |    |     |
| 34  | Change over Engine room blowers to supply/exhaust as required                                                                                  |     |    |     |
| 35  | Stop second generator if applicable                                                                                                             |     |    |     |

**REMARKS:**

**NOTE:**
1. Inform Bridge and Chief Engineer of any shortcomings that might delay acceptance of Stand by Engines.
2. Only accept Stand by Engines when engines are ready for manoeuvring.

__________________________  ____________________________
Duty Engineer               Chief Engineer
### E/R CHECKLISTS NO. 3 - DEPARTURE PORT

**VESSEL NAME:**  
**PORT:**  
**DATE:**

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<tr>
<td>1</td>
<td>Chief Engineer informed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Confirm required E/R staff at hand for <strong>maneuvering</strong> condition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Second generator started and taken on load, Check Emergency and Standby generators are on Auto and ready for immediate use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Engine order telegraph tried out, Communications with Bridge checked, Bridge and Engine Room clocks synchronized.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Steering gear tested, Both steering motors switched on. Steering checklist complied with.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Daily / Header / Sump tanks (HFO, MDO, LUB oil and FW tanks) brought to operational levels and drained of water as applicable.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Check Stern tube air guard system flow rate and oil tank pressure is normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Emergency air bottle pressed up to 30 bars and isolated.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Main air compressors operational and in Auto mode</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Main Start air reservoirs pressed up and drained of water. Reserve bottle isolated.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Control air system, filters, water traps and accumulators drained of water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>All loose equipments/received stores adequately secured as applicable</td>
<td></td>
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</tr>
<tr>
<td>13</td>
<td>Check all non running pumps are selected on <strong>&quot;Stand-by&quot;</strong> as applicable.</td>
<td></td>
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</tr>
<tr>
<td>14</td>
<td>Check all Engine Room Blowers on supply mode</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Check all HFO and LO purifiers operation is normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>All bilges transferred to bilge holding tank and no water under flywheel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>ER DB tanks, particularly Cofferdam, Bilge tanks and Sludge / Waste Oil Tanks sounded.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Check all overhauled machinery during port stay, for proper line set-up and operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Check Exhaust gas boiler circulating pump running</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Check power available for Deck Hydraulic machinery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>HFO Supply pump started. Auxiliary Blowers started on Auto</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>All Main Engine systems restored to operational status</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Propeller clearance obtained from Duty Officer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NO.</td>
<td>DESCRIPTION</td>
<td>YES</td>
<td>NO</td>
<td>N/A</td>
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<td>-----------------------------------------------------------------------------</td>
<td>-----</td>
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<td>-----</td>
</tr>
<tr>
<td>24</td>
<td>Main Engine turned a few revolutions on Turning gear after pressing pre-lubrication on &quot;HMI&quot; unit for cylinder lubrication in Control Room Console</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>Turning gear disengaged.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Main Starting air valve and Distributor air valve open after draining of water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Main Engine blown through on air after confirmation from bridge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>All Indicator cocks closed. Turbocharger drain clear and shut</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Make sure Main Engine is ready for manoeuvring. Give controls to Bridge.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Main Engine tried out on fuel in both directions from Bridge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>At standby take all Counters and Flow meters and record them on Maneuvering Book</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>32</td>
<td>All Counters and Flow meters taken and recorded on Maneuvering Book</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Shut Jacket water pre-heating steam</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Check all machineries parameters are normal during load up program</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Equalized both Auxiliary boilers pressure and couple them. Keep Boilers in Auto mode with selected Master / Slave.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Start fresh water generator</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Change over sea suction as per Chief Engineer’s instruction</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Power for both ICCP, FWD and AFT Switched ON</td>
<td></td>
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</tr>
<tr>
<td>39</td>
<td>Stop second generator once complete plant is stabilized</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:**
1. Inform Bridge and Chief Engineer of any shortcomings that might delay acceptance of Stand by Engines.
2. Only accept Stand by Engines when engines are ready for manoeuvring.

**REMARKS:**

__________________________  __________________________
Duty Engineer                Chief Engineer
# Appendix 4
## E/R Checklist No. 4

### VESSEL NAME:

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
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<th>NO</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Chief Engineer informed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Confirm required E/R staff at hand for maneuvering condition</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Second generator started and taken on load, Check Emergency and Standby</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>generators are on Auto and ready for immediate use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Engine order telegraph tried out, Communications with Bridge checked,</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>Bridge and Engine Room clocks synchronized.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Steering gear tested, Both steering motors switched on. Steering list</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>compiled with.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Daily / Header / Sump tanks (HFO, MDO, LUB oil and FW tanks) brought</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>to operational levels and drained of water as applicable.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Check Stern tube air guard system flow rate and oil tank pressure is normal</td>
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<td></td>
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<td>8</td>
<td>Emergency air bottle pressed up to 30 bars and isolated.</td>
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<td>9</td>
<td>Main air compressors operational and in Auto mode</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>10</td>
<td>Main Start air reservoirs pressed up and drained of water. Reserve bottle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>isolated.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Control air system, filters, water traps and accumulators drained of water</td>
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<td></td>
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<td>12</td>
<td>All loose equipments/received stores adequately secured as applicable</td>
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<td>13</td>
<td>Check all non running pumps are selected on &quot;Stand-by&quot; as applicable</td>
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<td></td>
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</tr>
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<td>14</td>
<td>Check all Engine Room Blowers on supply mode</td>
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<td>Check all HFO and LO purifiers operation is normal</td>
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<td>All bilges transferred to bilge holding tank and no water under flywheel</td>
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<td>17</td>
<td>ER DB tanks, particularly Cofferdam, Bilge tanks and Sludge / Waste Oil</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tanks sounded.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Check all overhauled machinery during port stay, for proper line set-up</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>and operation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Check Exhaust gas boiler circulating pump running</td>
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<tr>
<td>22</td>
<td>All Main Engine systems restored to operational status</td>
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<td></td>
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</tr>
<tr>
<td>23</td>
<td>Propeller clearance obtained from Duty Officer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Main Engine turned a few revolutions on Turning gear after pressing pre-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>lubrication on &quot;HMI&quot; unit for cylinder lubrication in Control Room Console</td>
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<td></td>
</tr>
<tr>
<td>25</td>
<td>Turning gear disengaged.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>Main Starting air valve and Distributor air valve open after draining of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>Main Engine blown through on air after confirmation from bridge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>All Indicator cocks closed. Turbocharger drain clear and shut</td>
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</table>
### E/R Checklist No. 4

<table>
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<th>DESCRIPTION</th>
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</thead>
<tbody>
<tr>
<td>29</td>
<td>Make sure Main Engine is ready for manoeuvring. Give controls to Bridge.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>Main Engine tried out on fuel in both directions from Bridge</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>At standby take all Counters and Flow meters and record them on Maneuvering Book</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**AT FINISHED WITH ENGINE (FWE)**

<table>
<thead>
<tr>
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<th>DESCRIPTION</th>
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<th>NO</th>
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</thead>
<tbody>
<tr>
<td>32</td>
<td>All Counters and Flow meters taken and recorded on Maneuvering Book</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Auxiliary blowers off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Indicator cocks open. Turbocharger drains open</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>Fuel Oil Supply pump switched off</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36</td>
<td>Turning gear engaged. M/E turned at least one revolution on turning gear after propeller clearance is given from Bridge. Turning gear disengaged</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>M/E Jacket cooling water pre-heating steam opened</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>Change over Engine room blowers to supply/exhaust as required</td>
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<td></td>
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<tr>
<td>39</td>
<td>Stop second generator if applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTE:**  
1. Inform Bridge and Chief Engineer of any shortcomings that might delay acceptance of Stand by Engines.  
2. Only accept Stand by Engines when engines are ready for manoeuvring.

**REMARKS:**

__________________________  ____________________________  
Duty Engineer                      Chief Engineer
### E/R CHECKLISTS NO. 5 - UMS OPERATION

<table>
<thead>
<tr>
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<tr>
<td>1</td>
<td>L/T fresh water tank level normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Steering gear oil (P&amp;S) oil level normal/no leaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Aux. Boilers (P&amp;S) press/water level/normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Boiler dosing tanks level normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Workshop m/c, Gas-Weld m/c power off/valves shut</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Cylinder oil service tank normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>HFO service/settling tanks drained for water/level normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Refrigeration compressors oil level/parameters normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>H/T fresh water tank level normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Air compressors/Dryer pressure &amp; oil level normal/no leaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Air reservoirs drained for water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Incinerator waste oil tank level/temperature normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>EGE soot blowers started sequence/observed/put on auto</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Hydrophore tank/sterilizer pressure/normal/no leaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>A/E fuel oil pressure/temperature/diff press normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>A/B fuel oil unit pressure/temperature normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Main fuel oil unit/back flush filter pressure/temperature/diff press normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Purifiers/feed pump pressure/temperature/amp/oil level normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Fresh water generator vacuum/shell temp/salinity normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Central coolers in-out pressure/temperature normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Cascade tank temperature/level normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Running Aux engine parameters, oil level normal/no leaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Stand-by Aux engine in remote start position</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Air-conditioning compressors pressure/amperes/oil level normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>ICCP panel readings normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>M/E cylinder head/Exhaust valve temperature, fuel rack normal/no leaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>M/E turbocharger oil flow &amp; temperature normal/no vibration</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28</td>
<td>Cylinder lubricators pumps pressure normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>Air cooler / oil mist detector temperature/mist level normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td>COPT platform no leaks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>M/E lube oil filter / cooler in-out press/temp/diff press normal</td>
<td></td>
<td></td>
<td>_</td>
</tr>
<tr>
<td>NO.</td>
<td>DESCRIPTION</td>
<td>YES</td>
<td>NO</td>
<td>N/A</td>
</tr>
<tr>
<td>-----</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----</td>
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<td>-----</td>
</tr>
<tr>
<td>32</td>
<td>All tank sounding pipes closed</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>33</td>
<td>Tank top / bilge wells no leaks/level below alarm float</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>34</td>
<td>Sump tanks / WO tanks / Sludge tank level/temperature normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35</td>
<td>scavenge air drain box inlet valve open</td>
<td></td>
<td></td>
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<tr>
<td>36</td>
<td>Stern tube air guard system / oil tank level/flow rate normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37</td>
<td>Shaft earthing potential millivolt reading normal (&lt;50mV)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>38</td>
<td>All pumps have stand-by selected on MSBD</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>39</td>
<td>Aux engines on stand-by remote start mode/ACB auto</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td>All fire loops confirmed on</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>Engine room entrance doors Shut</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>42</td>
<td>Duty / watch mode cabin/unattended</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>43</td>
<td>NK- Mist Fire Fighting System on Auto</td>
<td></td>
<td></td>
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<tr>
<td>44</td>
<td>Fire Pump on auto remote operation mode.</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>45</td>
<td>Informed bridge of going unmanned: informed</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Duty Engineer

Chief Engineer
E/R CHECKLISTS NO. 6 - AUXILIARY ENGINE START/STOP

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>STARTING FROM LOCAL STATION</td>
<td>-----</td>
<td>----</td>
<td>-----</td>
</tr>
<tr>
<td>1.</td>
<td>Engine control panel start position changed from Auto to Local</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Turning bar secured in position, Check no leaks and <strong>Ready to Start</strong> light is <strong>ON</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Check the sump tank and governor oil level, Check pre-lubricating oil pressure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Check cooling water supply and fuel oil temperature and pressures</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Check Alternator bearing oil level</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Change fuel link lever from Max position to Zero by turning the governor load indicator knob</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Open indicator cocks and blow through engines, Shut indicator cocks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Change fuel link lever from Zero to Max position by turning the governor load indicator knob</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Press Start button, Ensure engine running, Check running parameters are normal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Run engine idle for 5 minutes and change control position from Local to Remote</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Turn ACB Knob on main switch board to <strong>Close</strong> position. The generator frequency will synchronize and ACB will automatically close</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

|     | STARTING FROM ENGINE CONTROL ROOM                                          |-----|----|-----|

Make sure control is on Auto. Turn Start/ Stop knob on Main Switch Board to **Start**. Generator will start, Automatically synchronize with Main Bus Bar and come on Load **The generator should preferably be started from Local station**

|     | STOPPING                                                                    |-----|----|-----|

1. Turn ACB knob for outgoing Generator on Main Switch Board to **Open** Position

2. Run the Engine Idle for about 10-15 mins, and then turn engine Start/Stop knob to **Stop** Position

Duty Engineer

Chief Engineer
APPENDIX 5

EMERGENCIES SPECIFIC TO CHEMICAL TANKER

CHECKLIST NO. 1 : LEAK OF CARGO INTO DOUBLE HULL SPACES, COFFERDAMS.................................................. 1
CHECKLIST NO. 2 : TOXIC LIQUID RELEASE AT THE TERMINAL.............................. 1
CHECKLIST NO. 3 : TOXIC LIQUID RELEASE AT SEA.............................................. 1
CHECKLIST NO. 4 : BREAKAWAY FROM JETTY DURING CARGO TRANSFER... 1
Checklist No. 1: Leak of Cargo into Double hull spaces, Cofferdams

<table>
<thead>
<tr>
<th>VESSEL NAME</th>
<th>PORT</th>
<th>DATE</th>
</tr>
</thead>
</table>

If leakage of cargo into ballast tanks, cofferdams or other double hull spaces is suspected, the following steps are to be taken:

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Has the atmosphere at different levels in the tanks been checked? (Due to the complexity in the structure of double hull spaces, gas conc. may exist at different locations within the tank.) Is the tank being ventilated continuously?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Is the tank being sounded regularly to ascertain the rate of cargo ingress?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>If the quantity of the cargo leaking into the space is determined to be pumpable Is the cargo transferred to another cargo tank using Em’cy Deepwell pump.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Has anti-static precautions been taken?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Is entry into the tank prohibited until it has been established that it is safe for entry and there is no possibility of further ingress into the space?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Has an enclosed space entry checklist been completed and signed before entry into the space.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Has the correct toxic gas detector been used to check that the level is below the safe operational exposure limit?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Office informed?</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The vessel must also refer to its MCCM / VRP / SMPEP in case of any Major Casualty

MASTER
Checklist No. 2 : Toxic liquid release at the terminal.

<table>
<thead>
<tr>
<th>VESSEL NAME :</th>
<th>PORT :</th>
<th>DATE :</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Raise the alarm. The person who discovers the release should raise the alarm.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Stop all cargo operations and close all valves.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Notify the terminal staff of the chemicals involved and the possible risks posed to the personnel.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Notify port authorities through terminal staff or agents.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Prohibit smoking and use of naked lights throughout the ship.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Clear all non essential personnel from the area.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Close all accommodation access doors and stop all non closed circuit ventilation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Arrange for main engines and steering gear to be brought to standby.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Carry out notification as per procedures in WSM MCCM / SMPEP.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>The emergency party tackling the spill should wear protective chemical resistant clothing and breathing apparatus.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>If the quantity of the release is small, it can be collected using absorbent material for safe disposal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>If the quantity of the spilled liquid is large, contact the terminal / local authorities for further action</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: The vessel must also refer to its MCCM / VRP / SMPEP in case of any Major Casualty

MASTER
## Checklist No. 3: Toxic liquid release at sea.

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Raise the alarm. The person who discovers the release should raise the alarm.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Stop any work activities in area clear all non essential personnel from the area.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Master to maneuver the ship, if condition permit, so that vapours move away from ship accommodation, and operational space.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Close all accommodation access doors and stop all non closed circuit ventilation.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Eliminate all ignition sources, consider necessity of stopping main engines.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Access the extent of damage which lead to toxic liquid release.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>The emergency party tackling the spill should wear protective chemical resistant clothing and breathing apparatus.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Is the release continuing or complete.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Can some action be taken to control / reduce the release.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Carry out notification as per procedures in WSM MCCM / SMPEP.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>If the quantity of the release is small, it can be collected using absorbent material for safe disposal.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>If the quantity of the spilled liquid is large, contact the local authorities for further action.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Note:** The vessel must also refer to its MCCM / VRP / SMPEP in case of any Major Casualty
Checklist No. 4 : Breakaway from jetty during cargo transfer.

<table>
<thead>
<tr>
<th>NO.</th>
<th>DESCRIPTION</th>
<th>YES</th>
<th>NO</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Precautions before breakaway:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Vessel securely moored alongside?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Mooring lines maintained at all times?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Weather monitoring in port carried out? (By weather fax / Navtex / VHF / Shore weather reports)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Frequency of weather monitoring in port</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>− Tides / Currents for port calculated?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Contingency plans made?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− The wind velocity at which loading arms should be disconnected, cargo</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Operations stopped or vessel unberthed is specified?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Terminal emergency contacts available?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Harbour authority / Tug operators emergency contact available?</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Actions to be taken after breakaway from jetty:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Raise alarm / call emergency stations.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>− Stop cargo pumps / Stop loading using the nearest deck mounted emergency Stop.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Main engine in standby.</td>
<td></td>
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<tr>
<td></td>
<td>− Call for emergency assistance from tugs / Pilots.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Drain all cargo lines into slop / empty tanks.</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>− Drop anchor(s) if permitted ( if no pipelines under water)</td>
<td></td>
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<tr>
<td></td>
<td>− Use engines to steer the ship to safety.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Spill / Leak response / Use of Absorbent material.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>− Initiate notification as per procedures in WSM MCCM / SMPEP.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>− Consider using AFF foam over spilled area.</td>
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<tr>
<td></td>
<td>− Use of SCBA / chemical resistant clothing by persons close to spill.</td>
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</tr>
</tbody>
</table>

Note: The vessel must also refer to its MCCM / VRP / SMPEP in case of any Major Casualty

MASTER
APPENDIX 6 - WALLEM MARPOL COMPLIANCE PROGRAM (WMCP)

General
The guidelines and instruction in this annex are additional to the requirements of Marpol. Vessels are to comply with Marpol requirements and the instructions herein are voluntary additional company requirements based on industry best practice and our own experience.

Environmental Ethics
Environmental Compliance is extremely important to Wallem. There is an expectation that each and every employee, both ashore and afloat, demonstrates the Company’s commitment to protecting and sustaining the environment.

The Company has made available to all employees an Open Reporting Line, served by a 24-Hour phone (852 2876 8363) and a dedicated email mailbox (dpa@wallem.com), intended to facilitate the reporting of environmental non-compliance activity, environmental hazards, or a breach of any regulatory or Company policy related to environmental protection.

It is a requirement and expectation that every individual with knowledge of any deviation from Wallem Environmental Compliance Program or any otherwise unethical conduct shall report this to their department head or to the DPA as soon as practical.

Marpol Compliance statement
All crew members joining a Wallem managed vessels are to sign a Marpol compliance statement.

Coverage
Wallem Marpol Compliance Program (WMCP) coverage is limited to Marpol I and Marpol V.

The additional requirements are mainly with respect to Engine room wastes. There are no additional requirements under WMCP for sewage which is covered under Marpol IV.

The main focus of WMCP is for Engine room waste under Marpol I, garbage under Marpol V and as below for tankers under Marpol I.
Marpol I (WMCP) – Engine room waste
The additional requirements are mainly with respect to Engine room bilges. The Engine room wastes controls are mainly under three subsections:
1. Bilge water and OWS
2. Sludge and Incinerator
3. Recoding in ORB

Marpol I (WMCP) – Bilge water and OWS
Following are the requirements for Bilge water and OWS which is also captured in the Mind map on the next page.

OWS Discharge Pipes: They should be painted in Distinctive colour. The flanges should have numbered seals on the bolt to prevent unauthorized removal. The seal numbers should be recorded in the PMS. Visiting superintendents should check the actual seal numbers against the numbers in the PMS during attendance. Joining Chief Engineers should check the numbers on the seal against the numbers recorded in the PMS at the time of joining. Joining Chief Engineers should also remove one section of pipe* within one week of joining to ensure that the pipe is clear of oil. This should be done with office approval for breaking seal. After inspection, new seals to be put and records in PMS updated.

* in the presence of the outgoing C/E if time & operational constraints permit.

Control of Portable pipes: All portable pipes and pneumatic/portable pumps on board are to be kept in locker / box. The key for the box/locker is to be kept with Master & Chief Officer. A Register is to be maintained to record purpose for which pipes/ pumps are removed/used. All pipes should be tagged for their purpose.

Oily water separator:
The operation of OWS is to be done only under direct supervision of Chief Engineer and during daytime. Notice should be displayed at OWS sampling valve stating ‘Fresh water not to be opened during operation of OWS’. Notice to be also displayed stating the OWS operation is to be done only during daylight and under supervision of Chief Engineer’. OCM compliant with MEPC 107(49) should have a stencil mentioning that ‘date/time in UTC’.
Vessel should carry sufficient spares for Bilge pump and OWS. Vessels should have spare Coalescer/cartridges for OWS.

Others:
Bilge and Sludge lines should be completely isolated. If there is a common line, one section to be removed and blanks inserted at open ends. Seals should be inserted at the blanks. Discharge line isolated with the only common point being the shore connection. Office should be informed before making any modification to any of the lines. Office will then inform Class and Flag. Ships will be instructed to proceed only after the approvals are in hand.
Emergency Bilge valve and bilge suction valve of pumps (GS, Fire pump) to be sealed. Seal to be removed every three months with office approval to move the valves. New seals should then be put on the valve and the SMMS updated.
To minimize the possibility of suction of containments, floating oil and/or oily water exceeding 15 ppm which may compromise the efficiency of the OWS equipment, care should be exerted when disposing bilge water through the OWS, to avoid operating the OWS unit when the level in the BHT is reduced to less than 20% of the tank capacity.
Bilge water & OWS

Oily water separator

Operation of OWS

Notice - 'Fresh water not to opened during operation of OWS'
Notice - 'Operate only during daylight and under supervision of Chief Engineer'
Spare Coalescer/cartridges
Spares

OWS Discharge Pipes

Painted in Distinctive colour
Numbered Seals to be put on flanges of discharge pipes
Seals numbers to be recorded in PMS system

Control of Portable pipes

All portable pipes and pneumatic/portable pump to be kept in locker / box

key for box/locker to be kept with Master & Chief Officer
Register to be kept with pipes to record purpose for which pipes/ pumps are removed/used.

Others

Emergency Bilge valve and bilge suction valve of pumps ( GS, Fire)

Office approval
Re-sealed
Valves moved every 3 months
Seals to be put

Suction lines isolated
Discharge line isolated

One length removed
Blanks fitted
common line
Seals fitted on blank

Only connected at shore connection

WALLEM
SHIPMANAGEMENT LTD.

Chemical Tanker Manual

Prepared by: Marine Supdt (SID)
Checked: Director (SID)
Edition: Edition No. 4
Issue date: Nov 2014
Approved by: Director (SID)
Rev. Date: -
Appendix 6: Page 3
Marpol I (WMCP) – Sludge and Incinerator
Following are the additional requirements for Incinerator:
- Necessary spares on board for sludge pump and incinerator
- Old spares of incinerator such as nozzles kept for showing to PSC inspectors

Marpol I (WMCP) – Oil Record book entries
Below is a mind map of additional requirements on ORB entries. Vessel to comply with MEPC 1./Circ 736 for entries in ORB.

- Operational entries
  - Each entry countersigned by Chief Engineer
  - For OWS complying with MEPC 107(49), the record in the OCM checked to coincide with ORB entry
  - Pumping rate of bilge matches the OWS capacity
  - Burning rate of sludge matches incinerator capacity

- Maintenance entries
  - OWS and Incinerator maintenance entered under appropriate code

- Old records
  - More than 3 years – send to office
  - Superintendent will send to storage

- Any malfunction of equipment (OWS / Incinerator) to be entered in ORB

- Signed by Engineer who carried out operation
Change of Chief Engineer
New Chief Engineer should carry out the following on his joining:
- Check pipeline drawing with layout
- Check no connection between sludge lines and bilge lines
- Check seal number against records in SMMS
- Within one week of joining, open OWS discharge pipe to check condition on the inside of the pipe. If time and operational constraints permit, this check to be done whilst off-signing C/E present.
- Any defects to be advised immediately to vessel's superintendent and Manager
- Complete the Chief Engineers WMCP Self audit checklist and send to office with selected photographs within 7 to 15 days of joining

Superintendent attendance
Any office superintendent attending a managed vessel to check all items as below:
Change of Master

- Complete the Master’s WMCP Self audit checklist and send to office within 7 to 15 days of joining

Dry Dock work

Following additional work to be done during dry-dock:

- Bilge tank to be cleaned
- Bilge separated oil tank cleaned and heating coils checked
- All sludge tanks to be cleaned and heating coils cleaned, tested and repaired as required.
- Set up EGB wash water system, if required
- Fit an extractor to waste oil tank, if required
- Incinerator refractory inspected and repaired, as necessary
- OWS opened, inspected and cleaned; heating coils checked
- 15 PPM monitor calibrated/checked by vessel or manufacturer authorized workshop

Marpol V - Garbage

Following additional measures on Wallem ships:

- Plastic garbage bags are restricted to 150 pcs only. Vessel to maintain inventory of the garbage bags and these to be in custody and control of the Chief Officer
- Vessel to use only biodegradable bin liners
- Vessel to have wheelee bins for easy storage and disposal
- EGB wash water to have independent system for storing and disposal
- Correct Entries in Garbage logs as per actual disposal of garbage both quantity and time wise. Chief Officers should not make entries on rough estimate.
- Master’s should verify the entries in the Garbage log.
- When vessel is in special area, placard should be put up stating that vessel is in Special area with the discharge restrictions.
- Vessel to have compactor based on trading pattern and garbage storage

Marpol Pollution Prevention Equipment (MPPE)

The below guidelines are designed to meet the requirements of environmentally critical equipment as mentioned in Element 10 (Environment Management) of TMSA.

The following equipment’s are considered as Marpol Pollution Prevention Equipment (MPPE):

1. Oily Water Separator
2. ODMCS
3. Incinerator
4. Sewage Treatment Plant
5. Comminuter
In event of any failure or operation significantly below specifications of above mentioned MPPE which cannot be rectified by the ship’s complement, the Master must immediately report the matter to the office, to seek guidance for restoring normal operation.

When any MPPE is deemed to be in-operational, vessel is required to discuss with the office and implement alternate methods of retention, transfer and disposal of the affected waste as appropriate and in compliance with Marpol requirements.

Prior to the vessel’s arrival in port, the following must be complied with for non-functional MPPE:

1. The office to obtain “Dispensation Letter” from Flag State Administration authorizing to sail the vessel without the operating equipment until such time it can be repaired. The dispensation letter must be sent to the vessel prior to arrival at the next port so that the Master can present it to the Port State Control authorities

2. The Master must notify the local port state control authorities of the malfunctioning condition of the equipment in accordance with the specified local and international regulations. Master would also advise them of measures taken to retain and/or dispose the waste in compliance with Marpol requirements and send a copy of the relevant Flag Dispensation Letter to the port authorities through the vessel’s agent

Air Pollution compliance

All vessels in the fleet have Ship Energy Efficiency Management Plan (SEEMP). Masters and Chief Engineers are required to monitor and educate the ship’s compliment on the effect of vessel’s emission of harmful gases such as NOx, SOx, CO2 and GHG etc. on the environment.

Optimisation of fuel consumption, which in turn will reduce emission, by better Voyage planning, Cargo planning, Ballast management, Hull cleaning, Propeller polishing and any other such measures to be emphasized and discussed in the passage planning meetings on board.

Energy Efficiency Operating Index (EEOI) is calculated based on the Formula provided by IMO and Intertanko, on a Voyage to Voyage basis. Vessels is required to send the report to office through VRM, Voyage abstracts at end of each voyage. These are monitored and analysed in the office. The top management is provided with a consolidated report every quarter. The report compares the EEOI performance of vessels based on class and type of vessel.
WALLEM MARPOL COMPLIANCE PROGRAM (WMCP) – Masters Self Audit Checklist

Name of the Vessel:  ___________________________  Date:  ________________

Notes for Master: The checklist is to be checked and filled within 7 to 15 days of joining. The completed copy of this checklist is to be sent to the Superintendent with copy to the fleet. Any deficiencies noted should be sent in the text of the mail.

<table>
<thead>
<tr>
<th>1.0 General</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Marpol Special Area and ECA poster is available on board</td>
<td></td>
</tr>
<tr>
<td>1.2 Officers and Engineers on board aware of Marpol Special area and ECA areas</td>
<td></td>
</tr>
<tr>
<td>1.3 The Ballast water exchange record, Ballast handling log, Training with respect to ballast water management plan and Ballast water reporting forms for various port states maintained onboard</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.0 Marpol Annex I</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Master to Verify with Chief Engineer on the following</td>
<td></td>
</tr>
<tr>
<td>a) Proper functioning of all Marpol Pollution Prevention equipment ( MPPE) i.e OWS, Incinerator, Sewage treatment plant, comminuter and ODMCS for tankers</td>
<td></td>
</tr>
<tr>
<td>2.2 Master to check that ORB is being signed by C/E and duty Engineer for entries and Master is signing at bottom of page</td>
<td></td>
</tr>
<tr>
<td>2.3 Master to verify with all Engineers individually:</td>
<td></td>
</tr>
<tr>
<td>a) All Marpol equipment in good working condition i.e OWS, Incinerator, Sewage treatment plant, comminuter and ODMCS for tankers</td>
<td></td>
</tr>
<tr>
<td>b) Familiar with operation of Marpol equipment</td>
<td></td>
</tr>
<tr>
<td>2.4 For Tankers, ODMCS is operational and records in ORB ( Cargo ) are in order</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.0 Marpol Annex V</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Is the Garbage segregation satisfactory on the vessel?</td>
<td></td>
</tr>
<tr>
<td>Note for Master: Garbage segregation to be checked at the Garbage station, Galley, Pantry and cabins. There should be no paper, plastic or bottle fin bin marked “ food waste “ in the galley.</td>
<td></td>
</tr>
<tr>
<td>3.2 Entries in Garbage log are up to date, consistent and recorded regularly?</td>
<td></td>
</tr>
<tr>
<td>Note for Master: Check entries under different Categories made correctly. There should be no entry in cat B if vessel does not have comminuter and is in special areas. Cat B should normally be between .01 to .04 M3 with a larger amount on the first day after departure.</td>
<td></td>
</tr>
<tr>
<td>3.3 Entries in Garbage log for shore disposal is recorded correctly.</td>
<td></td>
</tr>
<tr>
<td>Note for Master: Entries should be made in Garbage log for garbage disposal ashore. Quantity in disposal ashore receipts should match the entries in the garbage log. Garbage landing certificates to be attached to the Garbage Log Book.</td>
<td></td>
</tr>
<tr>
<td>3.4 Does the vessel have a Waste Management Plan</td>
<td></td>
</tr>
<tr>
<td>Note for Master: the ship specific flow chart on page 27/120 should be highlighted as applicable to the vessel</td>
<td></td>
</tr>
<tr>
<td>3.5 Where applicable, do the entries for the disposal of cargo residue to sea include the start and stop times and their positions?</td>
<td></td>
</tr>
<tr>
<td>3.6 Are Special Garbage Wastes handled correctly?</td>
<td></td>
</tr>
<tr>
<td>Note for the Master: condemned batteries , expired medicines, condemned pressurized cans, printer cartridges and expired pyrotechnics to be only disposed to shore reception as per instructions in Page 11/120 of Garbage Management Manual &amp; Record book</td>
<td></td>
</tr>
<tr>
<td>3.7 Has the processing equipment on board as per Page 28/120 of the Garbage Management Manual and record book been completed?</td>
<td></td>
</tr>
<tr>
<td>3.8 Has the garbage storage table on page 29/120 of the Garbage Management Manual and record book been completed?</td>
<td></td>
</tr>
<tr>
<td>3.9 Officers aware of Wallem requirement for PSSA?</td>
<td></td>
</tr>
<tr>
<td>For Bulk carriers, officers aware that cargo residue can be disposed in PSSA with office approval?</td>
<td></td>
</tr>
<tr>
<td>3.12 Officers aware of no garbage disposal(including food waste) in Bohai Sea and Torres strait</td>
<td></td>
</tr>
</tbody>
</table>

Name of the Master:  ___________________________  Signature :  ___________________________
# WALLEM MARPOL COMPLAINCE PROGRAM – CHIEF ENGINEER SELF AUDIT CHECKLIST

Name of the Vessel: ___________________________ Date: ____________

Notes for Master: The checklist is to be checked and filled within 7 to 15 days of joining. The completed copy of this checklist is to be sent to the Superintendent with copy to the fleet. Any deficiencies noted should be sent in the text of the mail along with photographs.

## 1.0 General

### 1.1 Marpol Special Area and ECA poster is available in the ECR

### 1.2 Engineers on board aware of Marpol Special area and ECA areas

## 2.0 Marpol Annex I

### 2.1 Are seals fitted on OWS discharge pipes?

*Note for the C/E: Seal numbers should have been logged and informed to the office. Check the seal numbers on the flanges against the number logged in SMMS to ensure that they match and that no new seals have been put. Vessel should also have sufficient number of blue numbered spare seals.*

### 2.2 Is the bilge line as per drawing?

*Note for C/E: Any modification should have been advised to office and should have class approval.*

### 2.3 Bilge and Sludge Pump suction lines are completely isolated from each other?

*Note For C/E: If there is a common line, are the two lines isolated with one pipe length removed and with blanks at each remaining end which are tack welded and with numbered seals.*

### 2.4 Bilge & Sludge pump discharges are connected only for shore connection & nothing else?

### 2.5 Is the discharge line from OWS painted in a different colour?

### 2.6 Are seals fitted on OWS sampling line?

*Note for C/E: In most cases, clamps to be fabricated which would fit on the sampling line and the seals would be inserted on the clamps*

### 2.7 Are Seals fitted on the Emergency bilge valve and bilge suction valve of Pumps(Fire Pump, GS Pump or others as per class requirements)

### 2.8 Are Portable pipes on board kept locked?

*Note for the C/E: All portable pipes should be kept locked in a locker or box. All portable pipes are to have their use/function purpose painted on them The key for the lock should be with the Master and C/O. Vessel to also have a log to note down the date, time and purpose for which hose has been removed. Inventory of pipe should be available.*

### 2.9 Are their recommended spares of OWS, bilge and sludge pumps on board?

*Note for Chief Engineer: Coalescer / cartridges must be on board*

### 2.10 No Rough logs or sounding books to be used to maintain record of sludge tank soundings.

*Note for C/E: Vessel to use sounding board. Once the figures are entered in the ORB, the sounding of the previous day to be erased.*

### 2.11 Open OWS discharge pipe to check condition of the inside of the pipe. If time and operational constraints permit, this check to be done whilst off-signing C/E is present. Take a photo of the pipe removed before re-fitting.

### 2.12 Have new numbered seals been fitted and recorded in the SMMS

Name of the Chief Engineer: ___________________________ Signature: ___________________________
APPENDIX 7 - Safety Officer Inspection Checklist

<table>
<thead>
<tr>
<th>VESSEL NAME:</th>
<th>INSPECTION DATE</th>
<th>Wheelhouse</th>
<th>Accommodation</th>
<th>Galley</th>
<th>Main Deck</th>
<th>Forecastle</th>
<th>Pump room</th>
<th>Paint Locker</th>
<th>Boat Deck</th>
<th>Accod. Decks</th>
<th>Steering Room</th>
<th>Engine Room</th>
<th>Midship Stores</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NO</td>
<td>YES</td>
<td>INSPECTION ITEMS</td>
<td></td>
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</tr>
</tbody>
</table>

### SAFE MOVEMENT
- Means of Access Safe
- Space Clear of Obstructions
- Guard Rails are in Place
- Equipment Safely Stowed / Secured?

### ENVIRONMENT
- Illumination Levels Adequate
- Ventilation Adequate
- Any Unusual Odours
- Any Abnormal or Increase in Noise
- Appropriate Personal Protective Clothing Available
- LSA and FFE in Place and in Good Working Order
- Hazardous Substances Properly Stowed and Secured
- Any Pollution or Fire Sources Noticed

### WORKING CONDITIONS
- Adequate Machinery Guarding in Place
- Operating Instructions Available
- Safety Signs Displayed
- Permit-to-Work System in Use
- Equipment in Good Condition and Correctly Operated
- Adequate Supervision
- Any Practical Housekeeping Improvement possible

### OTHER
- Statutory and Company Regulations Complied With
- Shipboard Management Team informed of the defects

<table>
<thead>
<tr>
<th>Defect</th>
<th>Cause of defect</th>
<th>Corrective Action</th>
<th>Completion date</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</table>

Safety Officer: Chief Engineer: Master:

Please use extra page if space for Defect, Cause of Defect & Corrective action is not sufficient.
APPENDIX 8 - PRIVATE MARITIME SECURITY COMPANY (PMSC ) PROCEDURES

1.0 Applicability
These procedures would be applicable to managed tankers which are deploying armed security teams from Private Maritime Security Company (PMSC) on board the vessel for transit in the High Risk Area (HRA). The procedures would also be applicable to Non tankers to the maximum extent possible and would be considered as Best practice when applied on Non tankers.

2.0 Background
The Piracy situation off Somalia has developed since 2010. The industry responded with security measures and safer routing to keep clear off the area of attacks. The ‘Best Management Practice (BMP) ’ was developed by various military and industry groups coming together. The BMP details the measures to prevent boarding of vessels by pirate groups. However, the pirate groups increased their range in 2011 and were able to attack far from their coast. They were able to cover a wide area which included the Indian Ocean upto 078-00E and 12-00 S. This was primarily possible by the use of mother ships and also dhows to launch attacks on merchant vessels.

The change in tactics by the pirate groups required vessels to have additional measures. One of the measures identified as supplementary to the BMP is the use of armed security teams from PMSC. The fast changing situation required the armed security team to be deployed on vessels with the procedures being developed at the same time. However, the stabilization of situation has assisted in consolidating our procedures for the deployment of the armed security teams on board vessels.

3.0 Deployment of Armed PMSC
The deployment of armed security from PMSC would be done only after a risk assessment in the office. The risk assessment would cover the following:
   1. Vessels speed
   2. Vessels freeboard
   3. Piracy threat in the area of transit

Certain vessels with high speed and high freeboard like PCC would not require armed PMSC for transit in the HRA.
Wallem may use either a three man armed team or a four man team. The number of PMSC personnel will depend on vessels route and the level of piracy threats in the area of transit.
If charterers or owners have a specific requirement for a four man team, this would be complied with as far as possible and a four man armed security team arranged for the transit.
Wallem would then obtain quotes from various security providers and obtain owners approval for the deployment. Wallem has carried out due diligence audit of three security companies. To the maximum extent possible, only the armed security team from a PMSC where a due diligence audit has been completed would be deployed. However, armed security team from a Non audited PMSC may be used provided owners specific request has been obtained for their deployment. This would be done on a case by case basis provided the PMSC meets certain minimum criteria.

When vessel is on Charter to IMT or IMT affiliate, only PMSC from a security provider where a due diligence audit has been completed would be deployed. On vessels with Charter to Shell or to IMT, only a four man team would be deployed.

Once a PMSC has been selected, the Master will receive an E-Mail stating the name of the PMSC and their contact details. The purpose of sending the contact details is to ensure that the Master is able to regularly update the PMSC with the ETA to the port of embarkation.
Master is to ensure that vessel has sufficient lifeboat capacity for the number of additional personnel who would be joining. This is to be confirmed back to office for each transit. If the lifeboat capacity is not sufficient, flag would be approached to obtain authorization. Liferafts may be supplied to the vessel as required by the flag state in such cases or other measures takes as instructed by the flag state. Masters are to ensure that the PMSC would be provided with victualing and accommodation reasonably required for the Security Personnel equivalent to that provided to the Vessel’s officers. If this is not possible, Master to inform office so that additional resources can be provided or supplied as required.

The office will arrange for a BIMCO Guarcon contract or owner specific contract equivalent to Guardcon to the signed with the PMSC. Master would also receive a copy of the letter of indemnity to be signed by the security personnel from the PMSC on boarding along with the Rules on use of Force(RuF). The Master and the senior officers on board are to read through the Rules on the use of force which is specific to the PMSC selected. In addition, this section also has details on detection and engagement with pirate action groups (PAG).

All our tankers comply with flag state requirements for medicine chest. The medicines in the chest would be available to the PMSC personnel as required. All the PMSC personnel that have been audited also carry a full medical kit. The medical kit carried by the PMSC personnel has medicines and equipment specific to injuries, which may occur during the transit, which would include shrapnel injuries.

Master has responsibility to update the operations department of the PMSC with the ETA to the embarkation point for the PMSC personnel. This message should be updated every day and be copied to the office. In addition, any changes of over 6
hours is to be intimated immediately to the PMSC. This is to ensure that the team is able to embark in time and without any delay to the vessel.

4.0 Onboard Safety Induction for Armed PMSC Personnel

The PMSC personnel that board the vessel are also called armed security team or PMSC team in these procedures. The armed security team would board by launch at various locations just outside the HRA or just inside the HRA. The vessel should ensure that sufficient lee is provided for the safe transfer of the personnel and equipment. A risk assessment is to be prepared/reviewed for each transfer operations. Vessels are to be guided by the generic risk assessment which is available in the Appendix section of SBM II. A toolbox meeting is to be held prior to each embarkation or disembarkation to discuss safe embarkation or disembarkation of the armed security team.

As soon as the PMSC personnel boarding the vessel they are to sign on the ship’s articles as “Security Consultant”. A complete list of the weapons and associated kits carried by PMSC personnel is to be handed over to the Master. All these equipment’s will be listed as Security training Equipment.

Wallem has a Familiarization booklet for contractors. The PMSC personnel are contractors and have to read and sign the familiarisation booklet.

The familiarisation booklet contains:

1. Companies SHEQ policy
2. Companies Drug and Alcohol policy
3. Safety and emergency details (ship specific) including the enclosed space and hot work details as applicable.
4. Pollution prevention procedure
5. The ranks of the SSO and the deputy SSO
6. Details of items to be shown during the familiarisation round

Every vessel is different and so are the safety requirements. The armed security team is always led by a Team Leader (TL). The PMSC team will be given a ship specific safety tour and explained about the safety features of the vessel.

Safety procedures on tankers must be part of the briefing. They must be briefed on designated smoking room and on use of intrinsically safe equipment’s. The prohibition of use of mobile phones and cameras on deck must be part of the briefing of the PMSC team. Tanker restrictions such as smoking on the cargo deck or the use
of mobile phones must be clearly explained to the PMSC team. The pertinent Marpol requirements including garbage regulations must be informed to the PMSC team.

On tankers it is very important to explain the importance of keeping clear of areas susceptible gas accumulation during venting. The dangers of toxic gases when venting or carrying cargoes with toxic gases is also to be explained to the PMSC team.

5.0 Self Protection measure under BMP 4

Wallem has a standard list of security equipment. The standard list of security equipment includes the quantity of razor wire based on ships length. The standard list of security equipment also includes night vision binoculars, Kavalar jackets, additional pyrotechnics and chain link fence for the bridge wings.

Wallem also has a citadel policy and fortification of citadel is to be carried out as per requirements. Vessels will be supplied with an Iridium phone with external antenna for communication from the citadel.

All the ship security measures as per companies’ requirements are to be taken irrespective of whether the vessel is supported by an armed security team.

The presence of Armed security team does not replace existing self protective measures and procedures as recommended in Best management Practice (BMP) including safe routing and safe speed for the voyage.

REPORTING:

Masters are to also refer to Sec 5 of BMP 4

The Vessel would be registered for transit with MSCHOA from the office. The vessel is to send an Email to MSCHOA directly for any changes or update after vessel is registered. (Email: postmaster@mschoa.org). Please mention that vessel is already registered.

All Vessels are to report to UKMTO with copy to MARLO. (Details in BMP ver 4. and Anti Piracy chart). Vessel are to send Initial report as per format in BMP Ver 4 Appendix B and follow up with daily reports. While vessel is within 6 hours from IRTC or within the IRTC, six hourly reports are to be sent to UKMTO with copy to MARLO. (Format for reporting to UKMTO available in BMP ver 4 Appendix B).

Vessels owned by German companies should send the initial message to German Police at the email address bpol.see.ppz@polizei.bund.de. Thereafter Master is required to copy them all messages sent to UKMTO.
Vessels with Indian nationals on board or taking the Indian navy convoy are to send initial message to DGCOMM on e-mail id dgcommcentre@satyammail.net as per their format. If vessel does not have format, please contact office (Marine Safety Department).

Thereafter Master is required to send Daily messages on e-mail ID dgcommcentre@satyammail.net and 6 hourly report when vessel in IRTC.

a) UTC Date / Time: Position, Course, Speed and ETA Exit Point A or B.
b) Contact number of Wallem India Duty Officer is (Mob.) 91-9870855455.

Note: All messages to DGCOMM are to be sent only to them in the "To: field" and copied to Marine Safety Department and to Wallem India (Mumbai) for attention: Mr Dinesh Kumar (drj@wallem.com) and Capt N. Passey (np@wallem.com)

SECURITY MEASURES

The Best Management Practice guide Ver 4.0 has been sent to all vessels as E-Mail attachment. (Also available in SMS Documentation DVD). The hardening of the ship is to be completed before the vessel enters the High risk area.

The MSCHOA guidance and information to Masters is available in the SMS Documentation DVD. Please be guided by the contents. All ships are to be piracy hardened (Razor / wire, additional lookouts, etc.) on entering the high risk area.

Company has a specific policy on 'Citadel Space'. Citadel space is to be only used when it is inevitable that pirates are boarding the vessel. On sighting any boat approaching the vessel, all non-watch keeping staff are to enter the muster point which may be the citadel space or a space outside the citadel which has been designated as the mustering point. Only the watch keepers on the bridge and engine room to be outside the mustering point or citadel. The Engine control room is a good mustering point for the initial mustering. Once confirmed that vessel is under attack, the crew to move to the citadel space. It is to be always remembered that the best defence is efficient lookout and effective hardening of vessel. If pirates manage to board vessel, the remaining staff to enter the citadel space and secure themselves. The decision to take black out the ship to be taken by the Master based on the situation.

Vessel to carry out security drill prior transit which should include a Citadel lock down drill. Master is to also carry out briefing for staff on security measures. The iridium phone is to be tested from the citadel space with a test call to the CSO. Telephone numbers of UKMTO, MSCHOA and the CSO number must be available on the bridge and in the citadel space.

Ship Protection Measures are to be taken as applicable to the vessel. Pictures for rigging of razor wire and other security measures are available in Section 8 of BMP4. Page 30 of BMP 4 has pictures of razor wire rigged in double row. Please also refer
to our pictorial advisory on razor wire and chain link fence which is available in SMS DVD.

Where navigationally safe to do so, Masters are encouraged to practice manoeuvring their ships to establish which series of helm orders produce the most difficult sea conditions for pirate skiffs trying to attack, without causing a significant reduction in the ships speed.

Bridge protection measures include Chain link fence on the side and rear, fabricated aluminium plate for the side and rear windows and Kevlar jackets and helmets for the bridge team.

Securing doors and hatches, blocking external ladders with razor and fitting steel doors to accessible windows, should deny access to the accommodation and bridge. Doors fitted on escape route should be designed such that it can be opened by a crew trying to exit through the route or alternate path provided with manropes/coolie ladders.

Warning: If any hot work is required for securing vessel, vessels to follow procedures in Safety Manual. Hot work procedures and work for security measures to be documented and relevant checklist from Safety Manual to be followed.

Piracy alarm should be distinct and should not be a cause for confusion. Tools and equipment that may be of use to the pirates should be stored in secure location. Sandbags to be placed around the gas bottles or other flammable liquids stored in containers on upper deck.

During monsoon weather, attacks may occur in the outskirts of the HRA in the Gulf of Oman and in the Red Sea. Hence, vessels need to be cautious until well clear off the area.

**CITADEL SPACE**

Please prepare or check (if already existing) that the "citadel" space emergency station is complete with water, food, and Satellite phone. Citadel space to be well fortified with additional steel doors. The first muster point may be outside the ECR to evaluate the situation and the crew would then proceed to the citadel.

Please note following arrangements are to be made for the citadel:

All entrances to the citadel space should be well secured. The citadel should have adequate ventilation. It is recommended to place a wire mesh in the bottom flange of the ventilation to prevent smoke bombs thrown down into the citadel.
Communication is very important. Ships have been supplied with Satellite phone, which should be kept ready in the citadel space. The antenna should be camouflaged with the cover of navigation light.

There should be about 5 days of food and drinking water stored. In addition, there should be :-
(i) Minimum 12 torches + spare cells
(ii) Blankets for sleeping arrangements & towels
(iii) Toothpaste and toilet paper
(v) First aid kit
(vi) Medicine of any crew member who is on medication.

Indian authorities have banned use of iridium phone in their water. When calling ports in India, vessels should lock up the iridium or Thuraya phone. Vessels should also inform particulars of Thuraya, Iridium and other such sets in Pre Arrival Notification to the agents so that they can include in their Pre Arrival Notification on Security (PANS).

6.0 Checks on the PMSC

Wallem only uses standard security company where a due diligence check has been carried out to the maximum extent possible. However, PMSC from a non-audited company may be used provided owner’s specific approval has been obtained for their deployment. This would be done on a case by case basis provided the PMSC meets certain minimum criteria.

When vessel is on Charter to IMT or IMT affiliate, only PMSC from a security provider where a due diligence audit has been completed would be deployed. On vessels with Charter to Shell or to IMT, only a four man team would be deployed.

The security company would provide the passport copies of the PMSC personnel. CV’s of the PMSC personnel would be provided, if requested. Additional documents would be requested, if required or in case of need.

Flag state authorization is to be obtained prior to their embarkation. The authorisation would be obtained either from the office or by the PMSC based on the requirements of the flag of the vessel.

Below are details of major flags for authorization for armed security teams and for carriage of arms and ammunitions on board:

**Bahamas**: The PMSC would apply for license and this would be forwarded to the ships.
Panama: Wallem would apply to Panama authorities for each transit giving details of arms and the PMSC personnel. Authorisation is for each transit and the authorisation would be forwarded to the vessel.

Marshall Island: Flag issues No objection certificate which would be forwarded to the vessel. If vessel calling ports in India or in HRA, specific No objection with details of the arms/ names of team members needs to be obtained from the flag.

Liberia: Flag has issued a letter authorizing the carriage of arms. Vessels to send completed Annex 1 if calling ports with arms on board directly to the flag with copy to office.

Hong Kong: Flag issues a letter authorizing the carriage of arms and ammunitions along with armed security team. Vessels are to send Attachment if calling ports in HRA directly to the Marine department of Hong Kong with copy to office.

For other flags, details are checked by office and authorization obtained as required.

When calling at Ports with armed team on board, vessel to contact agents in good time and ensure that the arms and ammunitions declared correctly as per requirements. The weapons and ammunitions to be bonded during call at ports in HRA.

7.0 Duties to be performed by PMSC Personnel

The PMSC personnel would undertake Security Services using all reasonable skill and care and their responsibilities shall include the following (and other responsibilities as may be agreed):

(i) providing general guidance to the Crew and also carrying out such drills, training and preparations for the transit as the team Leader (TL) may recommend to the Master and the Master may agree;

(ii) advising and/or assisting with the hardening of the Vessel in accordance with BMP practices and, where applicable, in accordance with the guidance of BMP;

(iii) monitoring suspicious vessels or craft during the Transit;

(iv) advising the Master on security-related routeing issues;

(v) assisting the Master in liaising with UKMTO and MSCHOA and other authorities as appropriate and in accordance with the procedures set out in the BMP;

(vi) ensuring that at no time the Crew are permitted to handle the Firearms;

(vii) assisting/advising/training shipstaff during security drills, concerning evacuation to citadel space and conduct when pirates are attacking the ship.

(viii) In case the vessel is attacked and the Master and TL feels that they are overwhelmed and decide to move to the citadel then the security team will escort the bridge team to the citadel ensuring that the way is clear. They would
also assist in blocking internal doors to the citadel and place the security team in positions to best defend the citadel.

All messages like SITREPs and POSREPs should be done via the ship’s email system (with the Master’s permission) only. The armed security team carry their own satellite phone and may contact their office with this phone. The TL can also request the Master for the use of the ships phone for official business and this would be provided by the Master. In case the ships phone is used for personal calls by the PMSC team members, the charges as applicable may be charged by the Master.

8.0 Command Structure and “Use of Force”
PMSC team members embarked on the vessel are at all times subject to the overriding authority of the vessel’s Master. The Master shall, at all times have and retain ultimate responsibility for the safe navigation and overall command of the Vessel. Any decisions made by the Master shall be binding on the PMSC team. All PMSC team personnel are to act under the directions of the Master at all times. The Master retains the authority to order the Security Personnel to cease firing under all circumstances. However, for the avoidance of doubt, nothing shall compromise each of the Security Personnel’s right of self defence in accordance with applicable national law.

9.0 Flow chart of Process
The below chart is a rough guide for the various actions with reference to a vessel for PMSC personnel functions and preparing vessel
### 10.0 Activation of Alert and the risk of escalation

The PMSC personnel are bound by their rules of force document. The RuF is sent to the Master from the office prior to the embarkation of the PMSC team or directly by the PMSC.

In the event of any actual, perceived or threatened act of piracy and/or violent robbery and/or capture/seizure by third parties the Team Leader shall advise the Master or (in the Master’s absence) the Officer of the Watch that he intends to invoke the Rules for the Use of Force.

If a hostile approach is detected by the lookouts, the entire armed security team would be activated. The entire team would assemble on the bridge and take their positions.

Some of the factors that are to be considered when deciding a hostile target and before the use of force are:
a. The suspect vessel has followed numerous course changes that the vessel has made.
b. The suspect mother vessel has crossed the bow and skiff/skiffs launched, which are moving towards own ship at high speed.
c. The suspect vessel is on a high speed course towards the vessel after flares were fired.
d. Weapons, ladders, and scaling poles have been sighted and confirmed.
e. The vessel is fired upon.

When a hostile target is approaching and indicating hostile intent the PMSC personnel will respond with a graduated response if the situation permits. A graduated response means that the force used should progress from the least severe to the most severe subject to that which is appropriate.

1. PMSC team would first demonstrate a non violent challenge. This would include showing their presence by displaying weapons in the air.
2. If the hostile target continues to show hostile intent or act, the PMSC team would fire parachute flares.
3. If the hostile target persists in its approach, warning shots to be fired in the air above the boat or in water in front of the boat. If the PMSC is using tracer bullets, they should be used so as to alert the pirates that they have been noted and that the vessel is prepared.
4. The next escalation would be to fire at the boats engines or hull to prevent further progress without causing any injuries
5. In the event of the ‘honest belief’ of ‘threat to life’ and when all other methods of non-lethal force have been exhausted; and there is deemed to be no other way of stopping the attack, then lethal force can be contemplated and used. Lethal force would only be used as a last resort.

The PMSC personnel are at all times be guided by their Rules on Use of force. Master retains the authority to stop the firing and the armed security team would comply except in cases of self-defence.

The presence of the armed security team is a deterrent. Hence, display of weapon, firing flares and firing tracer rounds are important elements to provide visibility of their presence to the pirate action groups( PAG). On most occasions, this would be sufficient, as the PAG’s would withdraw once the presence of the armed security team is noted.

The chart below provides the flow chart for the activation of the armed security team and the various actions to be taken. The flow chart is a guide and the action taken would depend on the circumstances in that particular case. The Master in
consultation is at all times authorized to take all actions required for the Safety of the crew and the vessel.

A simplified user friendly chart for Typical escalation with Rules for use of force is provided in Sec 18.0. A copy of Sec 18.0 is posted on the bridge when vessel in HRA with armed security team.

### 11.0 Handling and stowage of weapons

On embarkation of the armed security team, as part of the initial meeting with the Master/SSO, the procedures for the carriage of weapons and ammunition and their storage whilst on board should be explained and agreed upon.

All weapons should be kept in possession of the security team at all times. At no point during the transit will the Master or crew handle the weapons. When the vessel is outside the high risk area, the weapon should be cleared of all ammunition. The weapons and the ammunition should be kept in the bonded store when the vessel is outside the high risk area or is in transit through the territorial water.

All weapons are to remain in an unloaded state during routine watches.
In the event that the team leader of the PMSC assesses that the weapons should be loaded due to an increased threat level then this is to be referred to and agreed with the Master as part of the escalation of force. In the event that the Master is not present then this request should be directed to the officer on watch (OOW).

If weapons have to be loaded at any time due to the escalation of force then it should be done on the bridge wings, pointing out to sea and in a safe direction. No drills are to take place inside the bridge/accommodation area. This includes stripping and assembling weapons for daily cleaning.

The details of the ammunition and the arms that are being embarked would be sent to the vessel prior to the embarkation of the team by the PMSC. Once the PMSC team is on board, the team leader would provide the Master with a list of equipment and weapons. The TL would maintain record of any ammunition used in test firing. If the weapons are bonded for calls to ports within the HRA, the Master must obtain a list of arms and ammunitions and these are to be declared. In any case, Master to obtain details from the agents and comply with any documentation required for the declaration of the weapons and the ammunitions.

(1) 12.0 Test firing of weapons

Test firing of weapons is required by the PMSC personnel to zero their weapons for accurate firing. The Security Team may carry out the ‘testing & zeroing’ of weapons as soon as possible after their embarkation and well outside any Territorial Waters (normally 12 NM from salient point of land). The Master should ensure that all the crewmembers are aware of the time of test firing and inside the accommodation during the period of test firing. No weapons test firing is to take place in territorial waters or into territorial waters.

Weapons testing and zeroing may only be conducted with the permission of the Master and with the agreement of the Security Team Leader who shall directly supervise the ‘testing & zeroing’ activity.

The following are to be complied with for test firing of weapons:

- Test firing shall be conducted only over the rail and in a secure area, with no other vessels in at least 6NM radius. This includes fishing boats.
- Hot Work Permit from Safety Manual shall be complied with for test firing. Hot work approval shall be obtained from the office as test firing is considered as hot work.
- No oil transfer operation, tank cleaning, gas freeing, purging or inerting operations shall be in progress during the test firing.
- All cargo tanks to be inerted with oxygen content less than 8%.
- Tank inert gas pressure to be monitored to ensure no inadvertent release of vapour.
• The area from which firing takes place shall be gas free and monitored with a combustible gas indicator to ensure that the reading remains below 1% lower explosive limit (LEL). This area should be as far as practicable from the cargo deck. It is recommended that the area selected is the aft section of the bridge wing.

• A perimeter safety zone shall be established around the selected weapons ‘testing & zeroing’ area and declared out of bounds for all ship staff.

• Test firing should only be done in the direction aft of accommodation. Master to establish a "safety zone". Only the Master or the SSO is permitted to witness this procedure from a protected location (i.e. the bridge wing). It is prohibited to test fire forward of the accommodation.

• Proper PPE including ear protection to be worn by the security team. Either the Master or the SSO should witness the testing and they shall have required PPE including Kavalier jacket and hear protection.

• Only a maximum of eight rounds is to be fired. Apparent wind should be blowing aft and not across the vessel.

• Master to record the date, time, position, number or rounds fired and direction of fire in the deck log book.

The spent shell from the test firing are collected by the TL for taking it back to shore. These are not to be handed over to crew members or disposed to sea. Prior to the test firing, the bridge watch to ensure that the area is clear of fishing boats.

13.0 POST INCIDENT REPORTING

All Piracy incidents are to be reported immediately by the Master to the Office. It is expected that the PMSC also report to their office. The incident should also be reported to UKMTO by the master or the PMSC team.

Many flag states require their specified form to be filled after an incident. The completed form to be sent to the flag state to report any incident. The Master and any other witnesses would send statement of fact for the incident.

If, during an exchange of fire, any individual(s) who comprised the Hostile Target are injured or killed and/or their Vessel(s) become damaged or destroyed, before the ship leaves the incident area, the Master and TL would appraise the situation and risk involved in rendering assistance

The following options can be considered:

• The deployment a life raft and survival equipment for the use of survivors; and
• Contact UKMTO with the exact coordinates and details of the incident.
• PMSC will contact his office while the Master will contact the DPA or deputy DPA.
In the event that a Hostile Target is identified and/or challenged and/or engaged in an escalation of force, statement of fact would be obtained from concerned persons including any event log, report and collate written statements from all persons present at the incident in anticipation of legal proceedings.

The following details to be sent as applicable and should be part of the report:

- Time and location of the incident;
- Identity and nationality of any persons involved including their addresses and other contact details if possible;
- Injuries/damage sustained;
- Circumstances leading up to the incident; and
- Any measures taken by the Personnel in response to it.

Any use or discharge of firearms that has resulted in injury, death or damage to property shall be reported to the Flag State authorities by the Master with copy to the office.

14.0 Apprehending Persons

The company requires the Master and crew to, not take in to custody or hold any persons except when apprehending persons to defend themselves or others against an imminent threat of violence, or following an attack or crime committed by such persons against vessel or crew. The decision to apprehend persons must only be made by the Master. Any such apprehension must be consistent with applicable flag state or international law

If requested by the Master, the PMSC will be requested to assist in the detention of personnel. The PMSC team will search the detainees to ensure they are fully disarmed and that there is no further risk to the vessel or the crew on the instructions of the Master.

Any such detention shall be reported to the company without delay. As far as possible the identity and Nationality of the detainees should be reported.

If a detainee continues to pose a threat and act aggressively, the PMSC team may be requested to secure the detainee individually, by their wrists forward of the body until they become passive. Once a detainee has been searched, he is to be secured under the direction of the Master. The location of the detainees is determined by the Master however they should be secured away from the bridge and crew quarters in suitable and appropriate accommodation.
The PMSC team may also be requested to assist the Master in unloading of any confiscated weapons. All confiscated weapons and ammunition are to be un-loaded, cleared and secured. A record must be kept of all confiscated weapons. An entry is to be made in the log book about the same.

UKMTO or the nearby coastal state is to be immediately informed so as to make arrangements for the transfer of the detained persons and confiscated weapons to Naval authorities. The flag state would also be informed at the earliest.

15.0 Watch keeping and vigilance

The vessels crew to remain vigilant and should not relax due to the presence of the armed security team. Good lookout must be maintained by ship staff as this greatly assists the security team in carrying out their duties. The members of the security team would complement the ships lookout team and is not a substitute for the ships lookout watch keepers.

16.0 Communication procedures

The communication procedures between the team and the ship's crew would be discussed at the initial briefing meeting. The security team would also inform the Master and the crew on their internal communication protocol. The communication should be tested. In addition, the Chief Officer should brief the TL on the work planned for the day on deck and the precautions and controls being exercised. If any hazardous operation is in progress, this would also be informed to the team leader so that they are aware of the area of the work, the precautions being taken and any other relevant information. Good communication between ship staff and the PMSC is essential for safe transits.

17.0 PERFORMANCE APPRAISAL

On completion of the transit a performance appraisal report of the PMSC to be forwarded to the company / operator. For voyages with IMT cargo or on charter with IMT, the appraisal form from IMT is to be used. Panama has a PCSAP report which is to be filled by the TL and given to the Master. Master should then forward this report to the office for forwarding to the relevant authorities. The office would also obtain the transit report from the PMSC for some of the voyages on a case by case basis. Any other reports on the performance of the PMSC teams as required by the flag states or the Charterers would be complied with.
18.0 Guidance on Typical Escalation

**GRADUATED RESPONSE**

**Suspicious Activity**
- Skiff sighted
- Ensure water spray system is activated
- All members of PMSC on bridge
- Weapons removed from storage and ready

- Maintain max CPA
- Master to bridge
- Ensure vessel at max speed

**Threatening Approach**
- Skiff continues approach & weapons/ladder sighted
  - Invoke RUF
  - PMSC to display weapons
  - Verbal Challenge on vessel’s external PA system
  - Tracer shot fired over boat with approval of Master

- Crew to internal safe muster area
  - Inform UKMTO, CSO and any nearby warships
  - Bridge team don PPE
  - Sound ship’s whistle

- Activate SSAS
  - Broadcast Mayday
  - Non watch-keepers to citadel
  - Intensify evasive manoeuvring

**Attack considered to be imminent**
- Hostile intent including firing
  - Minimum force with aimed shot to disable Engine/boat
  - Fire more warning flares
  - Aimed Warning shots in front of skiff
  - Further verbal challenges

**Own Vessel**
- Bridge Crew to citadel

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**Distance from own vessel:**
- **3nm**
- **1.5 nm - 0.8 nm**
- **400mtrs**
- **100mtrs**

**Weapons fired / Attempting to board**
- Aimed shots to breach hull
- Minimum use of lethal force if clear threat to life