INTERNATIONAL MARITIME ORGANIZATION

IMO

E

SUB-COMMITTEE ON STANDARDS OF TRAINING AND WATCHKEEPING
38th session
Agenda item 3

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VALIDATION OF MODEL TRAINING COURSES

Model course - Chemical cargo and ballast handling simulator

Note by the Secretariat

SUMMARY

Executive summary:	This document provides a draft model course on Chemical cargo and ballast handling simulator
Action to be taken:	Paragraph 5
Related documents:	MSC 50/27; STW 17/11; and STW 37/18

1 The Maritime Safety Committee, at its fiftieth session (MSC 50/27, paragraph 12.10), approved the procedures developed by the Sub-Committee, at its seventeenth session (STW 17/11, annex 5), for validation of model courses related to the implementation of the STCW Convention.

2 The Sub-Committee, at its thirty-seventh session (23 to 27 January 2006), concurred with the proposal by India to develop a simulator model training course relating to Chemical cargo (STW 37/3/2) and to submit it to the Sub-Committee for validation in due course (STW 37/18, paragraphs 3.7 and 3.10).

3 The preliminary draft of this model course was forwarded to members of the validation panel for their comments. The comments received have been incorporated as appropriate.

4 The final draft model course is set out in annex.

Action requested of the Sub-Committee

5 The Sub-Committee is invited to consider the above information and decide as appropriate.

***

ANNEX

MODEL COURSE X.XX

Draft

CHEMICAL CARGO AND BALLAST HANDLING SIMULATOR

International Maritime Organization

ACKNOWLEDGEMENTS

This course is based on training guidelines as produced and material developed by the Directorate General of Shipping, Government of India.

It has been prepared by training institutions based in Mumbai.

IMO wishes to express its sincere appreciation to the Government of India for its provision of expert assistance, valuable cooperation, and generous funding in support of this work.

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Introduction

▪ Purpose of the model courses

The purpose of the IMO model courses is to assist maritime training institutes and their teaching staff in organizing and introducing new training courses, or in enhancing, updating or supplementing existing training material where the quality and effectiveness of the training courses may thereby be improved.

It is not the intention of the model course programme to present instructors with a rigid "teaching package" which they are expected to "follow blindly". Nor is it the intention to substitute audio-visual or "programmed" material for the instructor's presence. As in all training endeavours, the knowledge, skills and dedication of the instructor are the key components in the transfer of knowledge and skills to those being trained through IMO model course material.

Because educational systems and the cultural backgrounds of trainees in maritime subjects vary considerably from country to country, the model course material has been designed to identify the basic entry requirements and trainee target group for each course in universally applicable terms, and to specify clearly the technical content and levels of knowledge and skill necessary to meet the technical intent of IMO conventions and related recommendations.

▪ Use of the model course

To use the model course the instructor should review the course outline and detailed syllabus, taking into account the information provided under the entry standards specified in the course frame-work. The actual level of knowledge and skills and prior technical education of the trainees should be kept in mind during this review, and any areas within the detailed syllabus which may cause difficulties because of differences between the actual trainee entry level and that assumed by the course designer should be identified. To compensate for such differences, the instructor is expected to delete from the course, or reduce the emphasis on, items dealing with knowledge or skills already attained by the trainees. He should also identify any academic knowledge, skills or technical training which they may not have acquired.

By analysing the detailed syllabus and the academic knowledge required to allow training in the technical area to proceed, the instructor can design an appropriate pre-entry course or, alternatively, insert the elements of academic knowledge required to support the technical training elements concerned at appropriate points within the technical course.

Adjustment of the course objectives, scope and content may also be necessary if in your maritime industry the trainees completing the course are to undertake duties which differ from the objectives specified.

Within the course outline, Part B, the course designers have indicated their assessment of the time which should be allotted to each subject area. However, it

must be appreciated that these allocations, are arbitrary and assume that the trainees have fully met all the entry requirements of the course. The instructor should therefore review these assessments and may need to reallocate the time required to achieve each specific learning objective.

▪ Lesson plans

Having adjusted the course content to suit the trainee intake and any revision of the course objectives, the instructor should draw up lesson plans based on the detailed syllabus. The detailed syllabus contains specific references to the textbooks or teaching material proposed to be used in the course. An example of a lesson plan is included in the instructor manual in most model courses, but in this course, the exercise scenarios supplied as an appendix to the instructor manual serve this purpose. Where no adjustment has been, found necessary in the learning objectives of the detailed syllabus, the lesson plans may simply consist of the detailed syllabus with keywords or other reminders added to assist the instructor in making his presentation of the material.

▪ Presentation

The presentation of concepts and methodologies must be repeated in various ways until the instructor is satisfied that the trainee has attained each specific learning objective. The syllabus is laid out in learning-objective format and each objective specifies what the trainee must be able to do as the learning outcome.

▪ Evaluation or assessment of trainee progress

The nature of this course involves all the trainees and the instructors in an ongoing process of individual and group evaluation.

▪ Implementation

For the course to run smoothly and to be effective, considerable attention must be paid to the availability and use of:

- ❑ properly qualified instructors
- ❑ support staff
- ❑ rooms and other spaces
- ❑ equipment
- ❑ textbooks, technical papers and
- ❑ other reference material.

Thorough preparation is the key to successful implementation of the course. IMO has produced a booklet entitled "Guidance on the implementation of IMO model courses", which deals with this aspect in greater detail. A copy of this booklet is included as an appendix to this course.

Part A: Course Framework

- **Course Framework**

- **Scope**

The course is essentially a practical one and consists of a series of exercises structured around the operation of the cargo and ballast installation of a Chemical tanker and carried out in conjunction with a simulator.

The exercises are controlled by an instructor and, initially, allow the trainees to become familiar with the layout of the cargo, ballast and deck tanks forming the system and the instrumentation and controls that are used.

The exercises continue with the simulation of the normal procedures and operations for the loading and discharging of cargo, the use of inert Gas, ballasting and de ballasting, Tank cleaning, Gas freeing, and, where the simulator design incorporates it, U-piece, Y-piece and jumper connections.

The importance of loading and discharging so as to avoid undue stressing of the hull are introduced at appropriate points of the simulator programme.

Each simulator exercise is preceded by a briefing lecture and followed up by a group discussion during which the actions and decisions of the trainees are analysed.

During the series of exercises the trainees will assume specific roles in the cargo or other operation that is being simulated, with one trainee taking the role of the officer in charge of the particular operation being simulated.

Note: Officers and ratings who are to serve aboard Chemical tankers are required by paragraphs 1 and 2 of Regulation V/1 of the International Convention on Standards of Training, Certification and Watch keeping for Seafarers, 1978 (as amended in 1995) to have appropriate experience aboard operational Chemical tankers and to have completed approved shore-based specialized training related to Chemical tanker operations.

It is not claimed that this course, using simulation of Chemical tanker cargo and ballast operations, meets the requirements of paragraphs 1 and 2 of Regulation V/1 of STCW 1978 (as amended in 1995) in respect of service aboard ship and shore-based training.

The IMO Model Courses 1.01 and 1.04 have been designed to meet the requirement of Regulation V/1 of STCW 1978, as amended in 1995 in respect of shore-based training; this course, using simulation, would provide them with relevant support and enhanced learning.

Objective

The trainees who successfully complete the course will make a safer and more effective contribution to the operation and control of the cargo and ballast installation of a Chemical tanker, which will improve ship safety and provide greater protection of the environment.

In particular, there will be:

- familiarization with the equipment, instrumentation and controls used for cargo handling on a Chemical tanker
- a greater awareness of the need for proper pre-planning, the use of checklists and the time scales involved in the various cargo handling operations
- an enhanced awareness to apply proper and safe procedures at all times when carrying out the various operations on board a Chemical tanker
- an acquisition of experience in identifying operational problems and solving them
- an improvement in the ability to make decisions which promote safety and protect the environment.

Entry standards

Entry to the course is open to merchant navy officers who wish to improve their knowledge and understanding of the operation and control of cargo and ballast operations, and other related operations on Chemical tankers. The course will provide a more formalized training to consolidate and enhance experience gained from service aboard a Chemical tanker.

Course certificate, diploma or document

On successful completion of this course, a document should be issued confirming that the holder has completed a short course on Chemical tanker cargo and ballast handling using a simulator. Administrations which approve such training as satisfying any part of the requirements of Regulation V/1 of STCW 1978 (as amended in 1995) should make an appropriate endorsement to the document.

Course intake limitations

The course intake is regulated by the number of trainees who can utilize the simulator for any given activity. For this reason the maximum number of trainees should normally be twelve. When circumstances demand it, the trainees can be split into two sub-groups of up to six in each group and activities be phased so that all students can receive the same period of training on the simulator.

The briefing and debriefing sessions can be carried out as main group or sub-group activities, according to circumstances.

- ## Staff requirements

  The instructor shall have appropriate training in instructional techniques and training methods (STCW Code, Section A-I/6). It is recommended that the instructor in charge of the course should hold a management level certificate of competency, and should have experience in the operation and control of cargo-handling operations on a chemical tanker, including the use of inert gas, Framo pumps and tank washing, with training and use of a simulator as a training aid. To operate the course successfully, at least one other instructor is required, preferably with similar qualifications and experience as the instructor-in-charge.

- ## Teaching facilities and equipment

  The cargo-handling system being simulated by the training installation should be modelled on an authentic cargo-handling system of a modern Chemical tanker, including its equipment, instrumentation and centralized cargo operations control centre, taking into account national, international and other requirements relating to safety and pollution prevention.

  The simulator complex should comprise of a “deck pipeline area”, "cargo control room", an "instructor unit", and a space for briefing and debriefing, with tables and chairs, a blackboard and, where such audio-visual aids are to be used, an overhead projector.

  The simulator unit should be based on a general-purpose computer system with real-time operating programs connected to the deck pipelines, cargo control centre and the instructor unit. Information print-out machines and visual display units should be incorporated into the system for trainees and instructors.

  The cargo control centre should contain a number of consoles covering the cargo and related systems, each with its own mimic diagram showing the system layout. The consoles will cover pumps, valves, instrumentation, communication, alarms, etc. Various operations such as loading, discharging, ballasting, inert gas, cargo tank inerting and cleaning, cooling down, purging cargo tanks etc. will be set up and controlled from the centre.

  The instructor unit should, preferably, be separate from the control centre and fitted with a window for observing and monitoring the trainee activity and progress.

  The instructor unit will have an appropriate console for monitoring the various processes and operations being simulated, and be capable of introducing commands and specific malfunctions in accordance with the training programme.

  Outline sketches on figures D1 and 3 of the instructor manual show the arrangement of a cargo-handling simulator installation and the tank arrangement of a Chemical tanker.

▪ Teaching Aids (A)

A1 Instructor manual and its appendix (Part D of the course)

A2 Liquid Cargo Handling Simulator (CHEMICAL)

A3 Videos
Chemical Tanker Operations Part 1: Cargoes, ships and legislation (Code No. 329.1)
Chemical Tanker Operations Part 2: Prevention of pollution (Catalogue Code No. 329.2)
Permit to Work (Catalogue Code No. 621)

Available from: Videotel Marine International Ltd.
84 Newman Street
London W1P 3LD, UK
Tel: +44 171 299 1800 Fax: +44 171 299 1818
e-mail: mail@videotelmail.com
URL: www.videotel.co.uk

A4 CBT Modules
CD # 7 Inert Gas Generator
CD # 39 Chemical Tanker Training System
CD # 93 Wall Wash
CD # 96 Cargo Compatibility

Available from: Seagull AS
Gamleveien 36, PO Box 1062
N-3194 Horten, Norway
Tel: +47 33 047930
Fax: +47 33 046279
e-mail: seagull@sgull.com
URL: www.sgull.com

A5 Database
Miracle Tank Cleaning Database

Available from: ChemServe GMbH
Kiebitzberg 20
D 21394 Kirchgellersen
Germany
Tel: +49 4135 808630
Fax: +49 4135 808631
e-Mail: info@chemserve-marine.com

▪ IMO references (R)

R1 International Convention for the Safety of Life at Sea, 1974 (SOLAS 1974) Consolidated Edition 1997, (IMO-110)

R2 International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 / 1995 (IMO-938)

R3 Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (BCH Code), as amended (IMO-772)

R4 International Code for the Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk (IBC Code), as amended (IMO-100)

R5 Medical First Aid Guide for Use in Accidents involving dangerous goods (MFAG), as amended (IMO-251)

R6 MARPOL 73/78 (Consolidated edition, as amended) (IMO-520)

R7 IMO Model Course – 1.04 – Specialized Training for Chemical Tankers

▪ Textbooks (T)

T1 ICS, Tanker Safety Guide (Chemicals), (London, Witherby Marine Publishing, 1974) (ISBN 0-948691-50-6)

T2 Tank Cleaning Guide. 4th ed. (Rotterdam, B.W. Chemical Laboratory "Dr. A. Verwey", 1988)

T3 U. S. Coast Guard, Chemical / Data Guide for Bulk Shipment by Water (Washington, D. C., U. S. Government Printing Officer, 1991)

▪ Bibliography (B)

B1 ICS/OCIMF/IAPH, International Safety Guide for Oil Tankers and Terminals. 4th ed. (London, Witherby Marine Publishing, 1996) (ISBN 0-948691062-X)

B2 M. Grey (ed.), Chemical / Parcel Tankers. 3rd ed. (London, Fairplay Publications Ltd, 1984) (ISBN 0-905045-67-X) [Out of print 1999]

B3 B. Bengtsson, Sea Transport of Liquid Chemicals in Bulk. 3rd ed. (Ockero, Sweden, B. Bengtsson and AB Inmar, 1982) (ISBN 91-970090-0-8)

B4 ICS / OCIMF / IAPH / IMTERTANKO / CEFIC / SIGTTO, Ship / Shore Safety Check List Guidelines. 1st ed. (London, Witherby Marine Publishing, 1982) (ISBN 0-854930-28-0)

B5 ICS/OCIMF, Ship to Ship Transfer Guide (Petroleum), 3rd ed. (London, Witherby & co Ltd., 1997) (ISBN 0-948691-49-2)

B6 N. I. Sax and R. J. Lewis, Sr., Hawley's Condensed Chemical Dictionary. 11th ed. (New Yorkm Van Nostrand Reinhold, 1987) (ISBN 0-442-28097-1)

B7 Bureau VERITAS. Gas and Chemical Ships Safety Handbook. 1st ed. (London, Lloyd's of London Press Ltd., 1986) (ISBN 1-85044-089-1)

B8 Drager – Tube Handbook. 11th ed. (Drager Sicherheitstechnik GmbH, Revalstrasse 1, D-23560 Lubeck, Germany 1998) (ISBN 3-926762-06-3)

B9 ICS, Safety in Chemical Tanker (International Chamber of Shipping, London, 1977)

B10 U. S. Coast Guard, CHRIS Manual 2, Hazardous Chemical Data. (Washington D. C., U. S. Government Printing Office).

B11 CFR title 46, Volume 5 part 150, US Government Printing Office, via GPO Access (http: www.access.gpo.gov/nara/cfr/)

Part B: Course Outline & Timetable

Course Outline

Subject Area	Approximate Time (Hours)	
	Lecture/ Discussion	**Practical**
1. **Familiarization** 1.1. Type of ship (**Chemical**) 1.2. Type of Tanks 1.3. Tank arrangements (General) 1.4. Pipeline arrangements 1.5. Pipe system, control valves, ESDS 1.6. Pumps 1.7. Instrumentation 1.8. Controls 1.9. Basic operations and procedures	1.5	4.5
2. **Special operations and Procedures** 2.1. Tank atmosphere evaluation 2.2. Use of Inert gas / Nitrogen etc 2.3. Cleaning of cargo tanks depending on next cargo types, compatibility 2.4. Gas freeing 2.5. Steaming of tanks (Deodorization) 2.6. Tank Cleaning in various Atmospheres 2.7. Tank Cleaning with Chemicals	3	3
3. **Ballast Operations** 3.1. General provisions 3.2. Ballasting 3.3. De-ballasting	1	3
4. **Cargo Operations** 4.1. General provisions (Cargo Planning, Cargo & Slop discharge Programme, CDP & SDP) 4.2. Loading (Pre-wash Operation) 4.3. Discharging (Pre-wash Operation) 4.4. Cargo Conditioning	1.5	8.5
5. **Operational Problems / Difficulties** 5.1. Cargo and related operations – normal working 5.2. Introduction of system faults, malfunctions, accidents 5.3. Remedial actions	1	3
SUBTOTAL	8	22
TOTAL	30	

Course Timetable

PERIOD / DAY	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5
1st Period (1.5 hours)	**1. Familiarization** 1.1 Tank Arrangement 1.2 Pipeline Arrangement	**2. Special Operations & Procedures** 2.1 Tank Atmosphere & Evaluation	2.5 Steaming of cargo tanks (Deodorization)	3.3 Ballasting 3.4 Deballasting	4.3 Discharging Cargo
BREAK					
2nd Period (1.5 hours)	1.3 Pipe system control valves, ESD 1.4 Pumps	2.2 Use of Inert Gas	2.6 Tank cleaning with various atmospheres 2.7 Tank cleaning with Chemicals	3.3 Deballasting 4. Cargo Operations 4.1 General Provisions (Cargo Planning)	4.3 Conditioning cargo 5. Operational Problems 5.1 Cargo & related problems (normal operations)
LUNCH BREAK					
3rd Period (1.5 hours)	1.5 Instrumentation 1.6 Controls	2.3 Cleaning of Cargo Tanks	**3. Ballast Operations** 3.1 General Provisions	4.2 Loading Cargo	5.2 Introduction of system faults, malfunctions, accidents
BREAK					
4th Period (1.5 hours)	1.7 Basic Operations & Procedures	2.4 Gas Freeing 2.5 Steaming of Cargo Tanks (Deodorization)	3.1 General Provisions 3.2 Ballasting	4.2 Loading Cargo 4.3 Discharging Cargo	5.3 Remedial Actions

Note: Teaching staff should note that timetables are suggestions only as regards sequence and length of time allocated to each objective. These factors maybe adapted by lectures to suit individual groups of trainees depending on their experience, ability, equipment and staff available for training.

Part C: Detailed Teaching Syllabus

The detailed teaching syllabus indicates the contents of the course and appropriate references and teaching aids.

- **Learning objectives**

The detailed teaching syllabus has been written in learning objective format in which the objective describes what the trainee must do to demonstrate that knowledge has been transferred. This format is an appropriate teaching and assessment tool to express:

- The depth of understanding of a subject and the degree of familiarization with a subject on the part of the trainee.
- What capabilities the trainee should really have and be able to demonstrate.

Every instructor is encouraged to teach learning in an 'objective-related' way instead 'material-related'. In this context, all objectives are understood to be prefixed by the words, 'The expected learning outcome is that the trainee is able to . . . '.

To indicate the degree of learning outcome of this course, the learning objectives for the Detailed Teaching Syllabus can be classified in three 'dimensions':

- C (cognitive)
- A (affective)
- P (psycho-motor)

Within a dimension, they are hierarchized by increasing complexity (C1 to C6, A1 to A5, and P1 to P5) where the complexity (depth, familiarization) is expressed (following B. Bloom and others) by a typical verb as follows:

Cognitive dimension of learning objectives:

C1	Knowledge	describe, outline
C2	Comprehension	explain
C3	Application	apply, perform, operate
C4	Analysis	analyse
C5	Synthesis	synthesize, construct, plan
C6	Evaluation	assess

Affective dimension of learning objectives:

A1	Reception; notice	recognize
A2	Response	respond
A3	Value	value
A4	Organization	organize
A5	Value characterization	accept, appreciate

Psycho-motor dimension of learning objectives:

P1	Imitation	imitate
P2	Manipulation	manipulate
P3	Precision	move, mark
P4	Co-ordination	co-ordinate (operations, menus)
P5	Naturalization	automate, internalize

- **References and teaching aids**

In order to assist the instructor, references are shown against the learning objective to indicate IMO references and publications, bibliographies, textbooks and other references, as well as additional teaching aids which the instructor may wish to use when preparing course material. The material is listed in the course framework. The following notations and abbreviations are used:

R	IMO reference
T	Textbook and other references
B	Bibliography
A	Teaching aid
Ap.	Appendix
An.	Annex
Ch.	Chapter
p.	Page
Para.	Paragraph
Sc.	Section

The following are examples of the use of references:

“R2”, refers to International Convention on Standards of Training, Certification and Watchkeeping for Seafarers, 1978 / 1995;

“B1”, refers to ICS/OCIMF/IAPH International Safety Guide for Oil Tankers and Terminals; and

“A1”, refers to the instructor manual in Part D of this model course.

- **Instructor Manual**

The instructor Manual (Part D) is included to provide additional information to instructors. It is designed to help further in structuring and organising a specific course. The instructor is recommended to gain additional technical material from simulators suppliers. Suppliers of simulators are also good sources of technical information.

The instructor should take pains to present the material within ‘a-use-at-sea’ context. It is not just a matter of imparting technical knowledge.

- **Note**

Throughout the course, safe working practices are to be clearly defined and emphasized with reference to current international requirements and regulations.

It is expected that the national institution implementing the course will insert references to national requirements and regulations as necessary.

- **Competence**

The competence required by candidates may be expressed in terms of the Conventions as follows.

1.1 Plan and ensure safe loading, care during the voyage and unloading or chemical cargoes.
1.2 Safely and efficiently perform the carriage of chemical cargo.
1.3 Control trim, stability and stress
1.4 Monitor and control compliance with legislative requirements and measures to ensure safety of life and protection of the marine environment.

Training outcome (as stated in Table A-II/2)
The standard of knowledge, understanding and proficiency associated with the above competences is therefore considered to be tabulated below.

1.1.1 Demonstrate knowledge of and ability to apply relevant international regulations, codes and standards concerning the safe handling and transport of chemical cargoes
1.1.2 Plan and execute Chemical tanker loading and unloading operations

1.1.3 Demonstrate a practical knowledge of chemical tankers and chemical tanker operations
1.1.4 Demonstrate a knowledge of the carriage of methane the precautions during loading and unloading and care during the voyage
1.1.5 Demonstrate an understanding of the factors affecting trim, stability and stress as applicable to chemical tankers.
1.1.6 Demonstrate a knowledge of maritime law embodied in international agreements and conventions, with special regard to:
- responsibilities under the relevant requirements of the International Convention for Safety of Life at Sea;
- responsibilities under the International Convention for the prevention of Pollution from ships as applicable to chemical tankers; and
- Methods and aids to prevent pollution of the marine environment by chemical tankers

- **Detailed Teaching Syllabus**

All objectives are understood to be prefixed by the words "The expected learning outcome is that the trainee is able to ……..…".

Knowledge, understanding and proficiency	**IMO Reference**	**Textbooks, Bibliography**	**Teaching Aid**
1. Familiarization (6 hours)	R2	B1, B2, B7, B9	A3
1.1 Type of Chemical Tanker Tank arrangement of the simulated Chemical Tanker			A2
1.2 Lists the tanks as			A2
1.2.1 Cargo Tanks 1.2.2 Ballast Tanks 1.2.3 Heeling tanks			
1.3 Shows the tank arrangement on a simple line diagram			A2
1. Describes the features of a chemical tanker.			
1.4 Pipeline arrangement			
1.4.1 Shows the pipelines of the simulated system on a simple line diagram.			
1.4.2 Compares the line diagram with the simulated mimic diagram.			
1.5 Pipe system control valves			A2
1.5.1 Shows on the line diagram developed for 1.4 the control valves and states their function.			

Knowledge, understanding and proficiency	IMO Reference	Textbooks, Bibliography	Teaching Aid
1.5.2 Describes the control valves used in the systems and explains how they function.			
1.6 Pumps			A1, A2
1.6.1 List the pumps used in the system in terms of:			
1.6.2 Centrifugal submerged pumps.			
1.6.3 Screw displacement pumps.			
1.6.4 Reciprocating pumps.			
1.6.5 Deep well pumps.			
1.6.6 Describes in simple terms, using line sketches where appropriate, the operation of cargo pumps used in the system (Framo, etc).			
1.7 Instrumentation	R1, R3, R4		A1, A2
1.7.1 Lists and briefly describes the instrumentation used in the simulated system of:			
1.7.1.1 Liquid level in tanks			
1.7.1.2 High level alarms: • Setting up of alarm system • Testing and maintenance • Advantages and disadvantages • As per IBC code, Chapter 15 (15.19.1 & 15.19.3)			
1.7.1.3 Quantity in tanks			
1.7.1.4 Liquid temperature			
1.7.1.5 Liquid pressure			
1.7.1.6 Rate of liquid flow			
1.8 Controls			A1
1.8.1 Lists the controls in the simulated system for 1.8.1.1 Valve actuator 1.8.1.2 Cargo heating 1.8.1.3 Pump start and stop			
1.9 Basic operations and procedures	R2, R5	T1, T3	A3
1.9.1 States that safe practice must be used at all times.			
1.9.2 States that cargo, ballast and tank cleaning operations must not result in marine pollution.			

Knowledge, understanding and proficiency		IMO Reference	Textbooks, Bibliography	Teaching Aid
1.9.3	States that as far as practicable a checklist should be prepared and used in each operation.			
1.9.4	Under supervision, constructs and uses a checklist for			
1.9.4.1	Loading cargo.			
1.9.4.2	Discharging cargo.			
1.9.4.3	Loading ballast			
1.9.4.4	Discharging ballast			
1.9.4.5	Draining and stripping			
1.9.5	Under supervision and using the checklist, sets (prepares) the simulator system for the operations of:			
1.9.5.1.1	loading cargo			
1.9.5.1.2	discharging cargo			
1.9.5.1.3	loading ballast			
1.9.5.1.4	discharging ballast			
1.9.5.1.5	draining and stripping			
2.	**Special Operations and Procedures (6 hours)**			
2.1	**Tank atmosphere evaluation**	R1	T1, T3	A3
2.1.1	States those operations such as loading and discharging cargo, tank washing and cleaning are hazardous because of the danger of fire, explosion, reactivity, corrosivity, toxicity.		B8	
2.1.2	States that for reasons of safety the tank atmosphere should be maintained in a non-explosive condition.			
2.1.3	States that this may be an inert atmosphere or, alternately, one which is too lean or too rich for an explosion to take place.			
2.1.4	States that a mixture of chemical vapours and air will only burn, or explode, if the concentration of gas is within the flammable range.			
2.1.5	defines			
2.1.5.1	lower flammable limit (LFL)			
2.1.5.2	upper flammable limit (UFL)			

Knowledge, understanding and proficiency		IMO Reference	Textbooks, Bibliography	Teaching Aid
2.1.6	States flammable range of chemical cargoes may be more than those of oil cargoes.			
2.1.7	States that all flammable, cargo, ballast and tank washing operations in cargo tanks should take place in an inert atmosphere.			
2.1.8	States that if inert gas is not available, tank washing with water can take place provided the tank, atmosphere has been made safe against explosion and that:			
2.1.8.1	This could be done by washing tanks in a too-lean, uncontrolled or a too rich atmosphere.			
2.1.8.2	It is difficult to maintain a too-rich atmosphere and is not recommended.			
2.1.8.3	If the ship is so equipped, tank washing should be done in an inert atmosphere.			
2.1.9	Explains that the ship's SMS requires special procedures to be followed if entering enclosed space.			
2.1.10	States that no one should enter a cargo tank unless their entry is sanctioned by a responsible officer.			
2.1.11	States that personnel should only enter empty tanks when they have been " gas freed" and the atmosphere in the tank has been verified for.			
2.1.11.1	O_2 content			
2.1.11.2	flammable vapour			
2.1.11.3	toxic vapour			
2.1.12	States those portable gas analyzers are used to ensure that the tank atmosphere has been properly gas freed.			
2.1.13	States that the gas analysers are usually of three categories.			
2.1.13.1	Oxygen meters.			

Knowledge, understanding and proficiency		IMO Reference	Textbooks, Bibliography	Teaching Aid
2.1.13.2	Combustible gas indicators or non-combustible gas indicators.			
2.1.13.3	Chemical absorption tubes.			
2.1.14	States that fixed oxygen analyzers are used to monitor the oxygen content in the inert gas supply to the tanks.			
2.1.15	Uses the simulator to measure the oxygen in the tanks.			
2.2	**Use of inert gas**	R1	T1	A4
2.2.1	Define Inert Gas, and			
2.2.2	List the states I.G is used in cargo tanker			
2.2.2.1	To protect cargo from polymerization, oxidation and humidity.			
2.2.2.2	To replace air to prevent fire and explosion.			
2.2.2.3	Incombustible (various metallic salts).			
2.2.3	Describes methods of production and supply of inert gas on Chemical Tanker.			
2.2.4	Explains why N_2 is used instead of inert gas.			
2.2.5	Sets (prepares) the simulator system to produce inert gas and supply it according to the plan of operation.			
2.2.6	Maintains a record (log) of the operation.			
2.3	**Cleaning of cargo tanks**	R6, R7	T1, T2	A1, A2, A4, A5
2.3.1	States tank cleaning can be done concurrently with cargo operation.		T3	
2.3.2	States tank cleaning of chemical tanks has to be pre-planned.			
2.3.3	Explains tank cleaning requires adequate shore reception facility for tank washing as per MARPOL			

Knowledge, understanding and proficiency			IMO Reference	Textbooks, Bibliography	Teaching Aid
		ANNEX II rules and regulations.			
	2.3.4	States for tank cleaning operation involving NLS, ships. Procedure and Arrangement Procedure and Arrangement (PA) manuals must be consulted.			
	2.3.5	List the factors in planning of a tank cleaning programme.			
	2.3.5.1	Last product			
	2.3.5.2	Next product			
	2.3.5.3	Reception facility and local regulations.			
	2.3.5.4	Environmental aspects.			
	2.3.6	Explains draining procedures.			
	2.3.7	Explains tank cleaning procedures – prewash, main wash, fresh water wash, spot wash, gas freeing, inspection/testing.			
2.4	**Gas Freeing and Ventilation**		R3, R4	T1, B7	A2
	2.4.1	States removal residues simplify tank cleaning.		B10	
	2.4.2	Vapours released may pose dangers to human health and may be objected by port.			
	2.4.3	Describes ship ventilation systems.			
	2.4.4	Explains gas freeing equipment.			
	2.4.5	Fixed fans			
	2.4.6	Portable fans			
	2.4.7	Ejectors			
	2.4.8	Wind sails			
	2.4.9	Explains ventilation & gas freeing depends on the weight of cargo and the shape of tanks.			
	2.4.10	States verifying the tanks condition is done by checking the tank atmosphere.			
2.5	**Steaming of tanks**		R3, R4	T1, T2	A4
	2.5.1	States that steam should be introduced into the tank only after GAS FREEING the tanks.			

Knowledge, understanding and proficiency		IMO Reference	Textbooks, Bibliography	Teaching Aid
2.5.2	States that steaming may be done for loading next cargo which is odour sensitive to the last cargo.			
2.5.3	States that steaming may not be permitted in some coated tanks.			
2.6	**Tank cleaning in different atmospheres**	R1, R7	T1, T2	A2, A4
2.6.1	States tank cleaning may be carried out in the following atmospheres:		B7	
2.6.1.1	Undefined			A1
2.6.1.2	Too rich			
2.6.1.3	Too lean			
2.6.1.4	Inerted			
2.6.2	Explains the different atmospheres.			
2.6.3	States the precaution for tank cleaning in port and at sea.			
2.7	**Tank cleaning with chemicals**	R6	T1, T2	A1, A2, A3
2.7.1	Demonstrates the use of tank cleaning guide.			
2.7.2	Explains the making of a tank cleaning plan using a tank cleaning guide.			
2.7.3	States Chemical tank cleaning requirements depend on			
2.7.4	Last cargo			
2.7.5	Next cargo			
2.7.6	Tank coating requirements			
2.7.7	States use of chemicals in tank cleaning may require additional safety precautions to be taken.			
3.	**Ballast Operations (4 hours)**			
3.1	**General Provisions**	R6, R7		A2, A3
3.1.1	States that ballast operation will be governed by national, international and other appropriate rules and regulations in order to prevent marine pollution.			
3.1.2	Uses procedures at all times which promote safety and protect the environment.			

Knowledge, understanding and proficiency		IMO Reference	Textbooks, Bibliography	Teaching Aid
3.1.2.1	States that on a chemical tanker ballast is required during and after loading/ unloading of cargo for :			
3.1.2.1.1	Maintaining the ship in the correct trim for discharge, draining and stripping.			
3.1.2.1.2	Establishing the required displacement and trim for manoeuvering and making a sea voyage.			
3.1.2.2	States that ballast / deballast of cargo tanks after NLS carriage should be done in accordance with the ship's P & A manual, thereby ensuring compliance with Annex II Marpol 73/78.			
3.1.3	States that segregated ballast tanks may not be used for cargo.			
3.1.4	States that ballast carried in cargo tanks will be contaminated with cargo residues.			
3.1.5	States that responsible officer to monitor distribution of cargo and ballast to ensure that at no time there is excessive stress on the ships hull.			
3.1.6	Explains U & L ballast tank can create stability problem.			
3.1.7	States compliance of local regulations to be followed with ballasting / deballasting.			
3.1.8	Ballasting			
3.1.8.1	Constructs a checklist covering the ballasting operation.			
3.1.8.2	Complies a ballast operation plan given the desired draught and trim for sea passage and taking into account:			
3.1.8.3	The tanks to be used			
3.1.8.4	The segregated ballast capacity			
3.1.8.5	The stability of the ship			
3.1.8.6	The induced stresses in the hull structure			

Knowledge, understanding and proficiency	IMO Reference	Textbooks, Bibliography	Teaching Aid
3.1.8.7 The discharging programme			
3.1.8.8 Sets (prepares) the simulator system and carries out the operation			
3.1.8.9 Maintains a record(log) of the operation			
3.2 Deballasting			A2
3.2.1 States that deballasting may be carried out at sea prior to loading cargo and during loading operations			
3.2.2 Constructs a plan for the deballasting operation, given the trim conditions needed for draining and taking into account:			
3.2.2.1 The tanks containing ballast			
3.2.2.2 The segregated ballast capacity			
3.2.2.3 The stability of the ship			
3.2.2.4 Induced stresses in the hull			
3.2.2.5 The loading programme			
3.2.3 Sets (prepares) the simulator system and carries out the operation, applying strict measures and control to prevent pollution.			
3.2.4 Maintains a record (log) of the operation.			
4. Cargo Operations (10 hours)	R1, R3, R4	T1, T3, B3, B4, B5, B6, B7, B10, B11	A2, A3, A4
4.1 Cargo Planning			
4.1.1 States that proper, planning required which promotes safety and protection of environment.			
4.1.2 Lists main points in planning as:			
4.1.2.1 Cargo requirements			
4.1.2.2 Compatibility			
4.1.2.3 Coating compatibility			
4.1.2.4 Tank capacity			
4.1.2.5 Discharging rotation			
4.1.2.6 Consultation of IBC/BCH code requirement			
4.1.2.7 Identity physical & chemical properties of MSDS sheets			

Knowledge, understanding and proficiency		IMO Reference	Textbooks, Bibliography	Teaching Aid
4.1.3	Demonstrates use of compatibility chart			
4.1.4	Explains the cargo handling procedures for			
4.1.4.1	Heating			
4.1.4.2	Padding			
4.1.4.3	Blanketing			
4.1.5	States that toxic cargoes cannot be loaded next to edible cargo and heated cargoes. Also heated cargoes cannot be loaded next to polymerizable cargoes.			
4.1.6	States FOSFA and other such international regulations are applicable for edible cargoes.			
4.2 Loading		R3, R4, R5,	T1, T3, B1, B4, B5	A2, A4
4.2.1	States cargo to be refused if sufficient information not available.			
4.2.2	States IBC/BCH codes provide operational requirement.			
4.2.3	States pre-planned cargoes should be stowed as per loading plan.			
4.2.4	Explains:			
4.2.4.1	Loading over top			
4.2.4.2	Drop line loading			
4.2.4.3	Loading through pump room.			
4.2.4.4	States atmosphere in cargo tanks and surrounding. Spaces may require special attention.			
4.2.4.5	Explains - inerting			
	• Padding			
	• Drying			
4.2.4.6	Explains - manifold sampling			
	• 30 cm. Sample			
	• Completion of loading-sample handling.			
4.2.4.7	Explains use of vapour return line.			

Knowledge, understanding and proficiency		IMO Reference	Textbooks, Bibliography	Teaching Aid
4.3	**Unloading**	R5, R6	T1, T3, B1, B4, B5	A2, A3
4.3.1	Plans the unloading of different parcels using a checklist.			
4.3.2	Lists the function test of all equipment to be carried out.			
4.3.3	Explains how drying or inerting requirement for the tank atmosphere are to be dealt with.			
4.3.4	Explains need for sampling during unloading.			
	• Sample taken prior unloading			
	• Sample taken at manifold at unloading comment			
4.3.5	States cargo with high vapour pressure may necessitate tank pressurizing.			
4.3.6	States some pumping systems have special stripping arrangements viz. Framo has inert gas cofferdam for creating discharge head so as to avoid the necessity of pressurising the tank.			
4.3.7	States requirements to monitor tank pressure so that it is always maintained below tank test pressure.			
4.3.8	Explains that unloading of NLS (Noxious Liquid Substances) shall be done in accordance with mandatory regulation pertaining to each pollution category as described in Annex II of Marpol.			
4.4	**Cargo Conditioning**	R7	T1, T3	A2
4.4.1 4.4.1.1	States the term “conditioning” refers to: Maintaining cargo quantity without undue losses during transportation passage.			

Knowledge, understanding and proficiency		IMO Reference	Textbooks, Bibliography	Teaching Aid
4.4.1.2	Maintaining cargo quality specification.			
4.4.1.3	Maintaining cargo temperature as instructed.			
4.4.1.4	Inerting, padding, drying conditions are maintained.			
4.4.2	Explains transport requirement of veg. oils, animal oils, and fats.			
5.	**Operational Problems (4 hours)**			
5.1	**Cargo and related operations – normal working**	R6	T1, T3	A2, A3
5.1.1	Uses the simulator system to obtain one or more operational situations as specified in the syllabus section 2, 3, or 4, to serve as a starting point for the introduction of faults, malfunctions or accidents.			
5.1.2	states examples of such operational situations as:			
5.1.2.1	Ship making a ballast voyage to a loading port with all ballast tanks full of Taking on cargo tank ballast after chemical tank cleaning.			
5.1.2.2	Examining valves in a cargo tank on ballast voyage.			
5.1.2.3	Attending the draught required for going along side on arrival			
5.1.2.4	Loading cargo tanks to 98% of capacity with different density cargoes.			
5.1.2.5	Loading multiple tanks with a grade of cargo using single/ twin manifold.			
5.1.2.6	Pollution control.			
5.1.2.7	Considerations of stability and hull deflection.			
5.1.2.8	Fire prevention.			
5.1.3	Ship making a loaded voyage to a discharge port with all cargo tanks full of small cargo parcels taking into account.			

Knowledge, understanding and proficiency		IMO Reference	Textbooks, Bibliography	Teaching Aid
5.1.3.1	After going alongside, all cargo is to be discharged.			
5.1.3.2	Two cargo tanks are to be pre washed as per the requirements stated in the tank cleaning procedures of MARPOL Annex II			
5.1.3.3	Required draught and trim for draining and making a ballast voyage.			
5.1.3.4	Pollution control – such as spill – prevention measures			
5.1.3.5	Considerations of stability and hull deflection.			
5.2	**Introduction of system faults, malfunctions, accidents**	R6	T1	A2
5.2.1	States that during cargo handling, ballasting and other associated operations, visual vigilance must be maintained, with instrument and meter readings being kept under constant scrutiny in order that any variation from the normal working conditions can be detected quickly.			
5.2.2	States that any deviation from the normal must be followed up to determine what is happening.			
5.2.3	States those considerations of safety and pollution prevention are paramount when normal becomes excessive.			
5.3	**Remedial actions**		T1	A2
5.3.1	With visual observation and/ or instrument and meter readings indicating a deviation from normal operational conditions, action must be taken to:			
5.3.1.1	Identify what is happening as quickly as possible. Follow a logical reasoning process.			

Knowledge, understanding and proficiency		IMO Reference	Textbooks, Bibliography	Teaching Aid
5.3.1.2	Bring the operational conditions back to normal by alteration of settings if this is possible.			
5.3.1.3	Slow the operation down, or shut the operation down if a hazard involving safety and pollution is imminent.			
5.3.1.4	Investigate the possible causes for the deviation from normal and take remedial action once the cause has been properly established.			

Part D: Instructor Manual

- ## General

  This manual reflects the views of the course designer on methodology and organization, and what is considered relevant and important in the light of his experience as an instructor. Although the guidance given should be of value initially, the course instructor should work out his own methods and ideas, refine and develop what is successful, and discard ideas and methods which are not effective.

  Preparation and planning constitute a major contribution to effective presentation of the course.

- ## Lectures

  The main training components in the course are the practical exercises carried out under supervision on the simulated cargo-handling plant, an example of which is shown in Fig.1. However, before each exercise commences, a briefing and discussion on important aspects of the exercise has been found effective, and provision has been made for this in the course structure.

  As far as is possible, the briefing for the exercise should use practical examples involving real shipboard equipment and systems, referring to diagrams, layout plans, technical drawings, photographs and other related technical documents to supplement and reinforce the briefing. A typical example of a Chemical tanker is shown in Fig. 3.

  A technique which has proved effective is to outline what is to be done and achieved by the exercise, then explain in detail those aspects which are felt to be important, and finally, to summarize the exercise, using key words and phrases.

  There should always be a final discussion to make sure that each trainee understands the role he will play and what is to be done and achieved by the exercise.

  A useful teaching aid during the briefing is an overhead projector; copies of the transparencies used can be distributed to the trainees for reference purposes during the exercises.

- ## Simulator exercises

  The cargo-handling plant and systems used aboard merchant ships which transport Chemical products can differ in their layout and in the types of machinery units and associated systems, so that the trainees will have varied knowledge and experience of such plant.

It is important, therefore, to use the briefing period to explain precisely which machinery units and systems are being simulated in the exercise, as well as their function, how they interact with each other and the role of the trainees during the exercise.

The trainees should be encouraged to co-operate with each other, working together as a team during the exercise, and to show the initiative and enthusiasm that will bring the exercise to a successful conclusion.

An important aspect of cargo and ballast handling is safety, and it is vital to ensure that safe practices are used throughout the exercise. Safety should be stressed during the briefing. One major contribution to safety is the use of checklists, which should be prepared beforehand, possibly as part of the briefing procedure.

During an exercise it is useful if one trainee assumes the role of officer-in-charge, with the responsibility of ensuring that the requirements and activities of the exercise are properly carried out. Role playing is an important element in the learning process, and with a number of trainees taking part in the exercises on the simulator, this aspect could provide a stimulus to the process of gaining knowledge and understanding. This could be performed with the officer in charge being located cargo control room and the watchkeeping officer on deck control, the two communicating with each other via intercoms or walkie talkies.

- **Preparing and conducting exercises**

If further exercises are to be developed, or the ones supplied in the course modified, it is important that they should not be too complex; otherwise the trainees might have difficulties in carrying out their tasks and duties within an allotted period of time.

An exercise should start with simple activities, making use of uncomplicated components such as valves, pumps, fluid systems, tanks, etc., and move step by step into more complex activities.

The aim of the training programme is to use a step-by-step process to introduce the trainees to the range of activities associated with the operations of loading and discharging an oil cargo.

For this reason a number of activities termed "Special Operations and Procedures" have been grouped together to form section 2 of the syllabus.

Of course, on board ship these operations would not be carried out in isolation, because they are all linked to other operations.

However, initially it is beneficial to study such operations in isolation, so that what is taking place can be observed and studied without reference to some other activity.

When the course has progressed to section 4 of the syllabus, all activities dealt with in sections l, 2, and 3 will be used in the simulated activity of loading and discharging a cargo of various chemical parcels.

The simulator is designed to provide training for normal operational procedures and for the input of abnormal or malfunction conditions. It is important that the trainees achieve a satisfactory level of competence under normal conditions before proceeding to abnormal operations due to the introduction of faults.

The exercises should provide the trainees with the most realistic impression of actually being in a cargo control centre aboard ship. Realism is important for this type of learning process. For this reason, if the simulator has an associated sound system, it should be used.

▪ Exercise scenarios

The content of a scenario is governed to a large extent by the units and systems that are being simulated.

The syllabus used for the course has been structured to provide some flexibility in this respect, and the scenarios can be prepared using those syllabus elements which match a specific simulator design.

For this course, scenarios should be designed to cover the operational areas contained in the syllabus; for example:

- ❑ Familiarization
- ❑ Special Operations and Procedures
- ❑ Ballast Operations
- ❑ Cargo Operations
- ❑ Operational Problems.

The familiarization scenarios should aim at making the trainees not only feel "at home" with the units and systems being simulated, but should also provide some "hands-on" experience with the controls and some of the more basic equipment and operations, such as valves, pumps, pipe systems, instrumentation, filling and emptying tanks, etc.

The operational scenarios should aim at providing experience in preparing and carrying out the various tasks and procedures that are involved with the safe transportation of liquefied Chemical in bulk.

The troubleshooting scenarios should be designed to provide experience in identifying malfunctions and faults, and applying remedial procedures. It should be noted that most simulator designs can introduce a large number of malfunctions and faults. In this course, the scenarios can only deal with a few faults because of time constraints. The course implementer is free to introduce additional faults if time allows, or to change the faults to comply with a particular simulator design.

Further details regarding the content of the scenarios are provided in the guidance notes (appendix of the instructor manual).

- **Monitoring the exercises**

During the exercises the instructor should monitor the trainees' progress and record particular events which relate to safety or correct procedure in the exercise, making a summary for use in the debriefing period. However, even an experienced instructor may occasionally find things going wrong when trainees are trying to control all the parameters and actions involved in an exercise, and any resulting incidents should be noted and discussed at the debriefing.

If a second instructor is available, he should assist in monitoring the trainees in their work. His task will vary according to the trainees' abilities and competence. He will be involved not only in the briefing and debriefing activities, but also when the trainees become more experienced, assisting and guiding them in the use of the equipment. He should follow their work closely, but should avoid interrupting them and save important observations for the debriefing.

- **Debriefing**

The time spent on debriefing should generally occupy between 10 and 15 per cent of the total time used for simulator exercises. Various facilities may be used in debriefing, such as playback (in which the whole exercise is recorded and any sequence is available for discussion), multi-channel recorder or data-logging equipment.

The instructor should refer to the summary made during the exercise, raise important points and direct the discussion among the trainees. He should encourage them to examine critically the actions taken during the exercises. He should try to avoid imposing his own views, but should ensure that the trainees have used safe and correct procedures at all times.

- **Guidance on specific subject areas**

The guidance notes which follow contain advice on the treatment of the subject areas listed in the course outline. The instructor should develop a methodology based on his own experience, together with the advice and guidance provided with the simulator being used in the course.

- **Guidance Notes**

These notes contain advice on the content of the course as given in the course outline and the syllabus, and will provide a basis for the construction of suitable scenarios.

- **Familiarization (6 hours)**

Initially it is important that the trainees become familiar with what is being simulated and the simulator layout and controls.

Therefore the first briefing and discussion must cover at least:

- the cargo-handling plant, its systems and equipment in general arrangement and in specifics such as the cargo system and arrangements for ballast and inert gas generation.
- the instrumentation being used and what parameters are indicated and recorded
- the controls that are used and where they are located
- the alarms that are fitted and what they protect
- the observance and use of safe practices and procedures at all times
- the importance of proper planning before undertaking any activity in the machinery spaces
- the use of checklists to ensure that actions and activities are safe and carried out in the correct sequence.

The practical exercises should start with simple activities involving such operations as:

- opening and closing valves
- starting and stopping pumps, compressors and vaporizers
- using a checklist to prepare the simulator for loading cargo and filling a cargo tank
- using a checklist to prepare the simulator for handling ballast and
- transferring ballast from one tank to another tank.

The trainees should note and record important instrument readings during the exercise.

The aim is to make everyone familiar with the layout of the plant, the instrumentation used, and the location and use of controls.

- **Operational Exercises (20 hours)**

The aim of these exercises is to make the trainees familiar with the cargo-handling units and the associated systems that are being simulated, and to gain experience in the correct and safe procedures for preparation, start up, putting on line, and setting the normal operating mode.

Sufficient procedures and operations have been identified in the syllabus to cover most simulator designs, so that adequate practice can be obtained in the operations that are used in the transport of chemical cargo.
With the trainees becoming familiar with the simulator and the range of activities it can handle, scenarios can be constructed covering the various operations contained in the syllabus objectives, and specimen scenarios are provided as an appendix to the instructor manual.

It is important that the trainees become accustomed to making up and using checklists for each operation, so that all actions are carried through in the correct sequence and in a safe manner.

- **Troubleshooting (4 hours)**

These exercises aim at developing skill and confidence in handling operational problems. A number of possible faults can be listed, such as:

– discharge of contaminated water, because of
  - defective monitoring instruments
  - ineffective control being exercised, or
  - wrongly set valves

– flow rate from pump insufficient, because of
  - too much clearance between impeller and casing in a centrifugal pump (usually because of wear or corrosion), or

– leak developing in a discharge line
  - leaking of chemical from the gland of the pump

but the particular simulator design will determine which faults and malfunctions can be introduced.

It is important that the number of faults which are introduced can be dealt with in the time available.

Only one fault should be dealt with at a time, and the next fault should not be introduced until all the trainees are satisfied with the way they have handled the previous one.

The instructors should not intrude too much in these exercises, and should allow the trainees to sort the problem out for themselves.

It is essential to allow sufficient time in debriefing to explore thoroughly the way in which the fault was identified, located and dealt with.

Each simulator design will incorporate its own catalogue of faults and malfunctions, and the manufacturer's guidance should be used to construct appropriate scenarios.

Bibliography (B)

The detailed teaching syllabus together with the instructor manual and its guidance notes and the user guidance from the simulator manufacturer is all that is required to implement the course. However, if supplementary reading or reference is desired, the publications (as mentioned in Bibliography section)

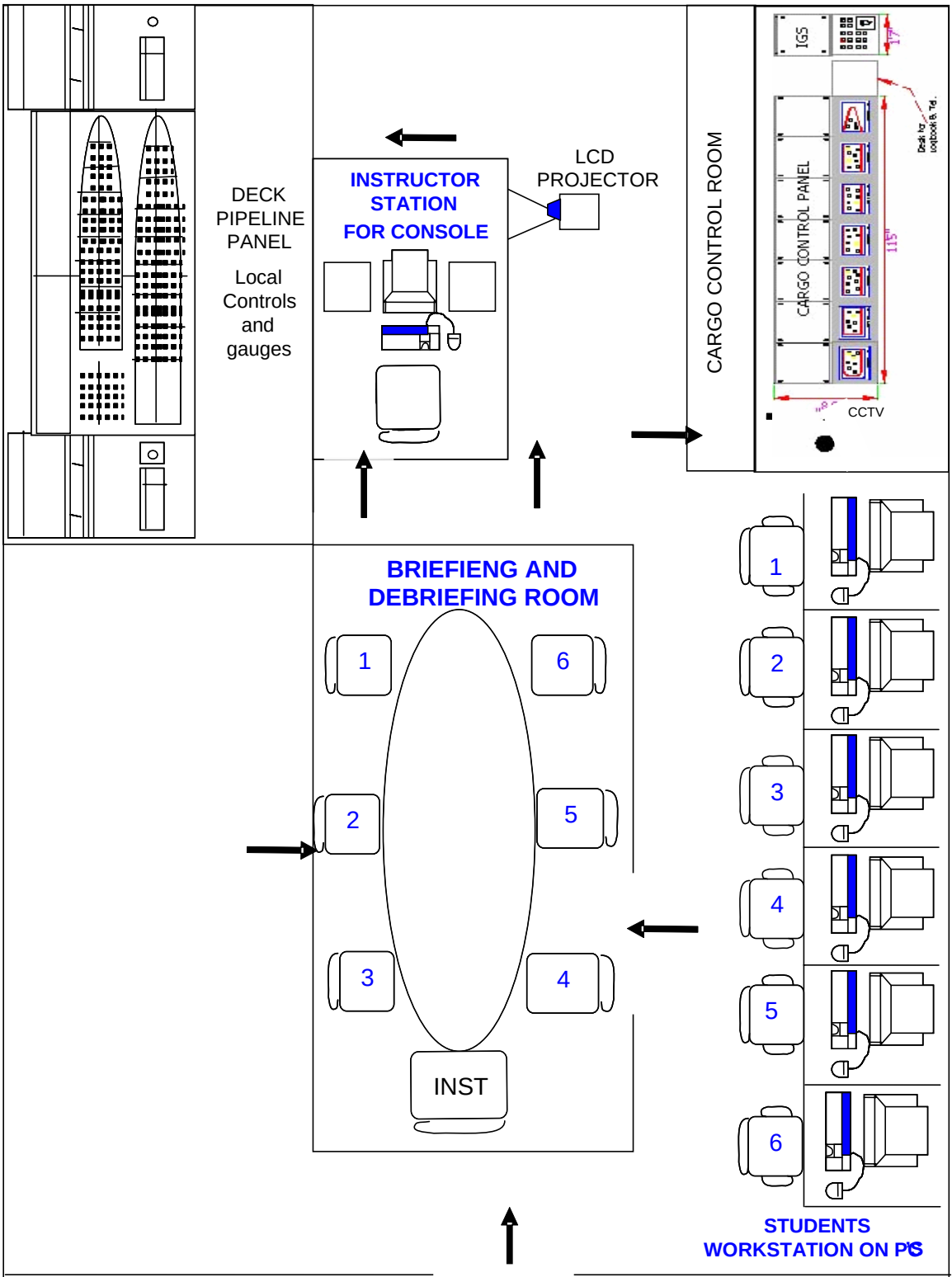


Fig D1: Outline sketch of a Chemical Tanker cargo and ballast handling Simulator installation

Annex to Instructor Manual

Figures for use by the presenter
Use on OHP (transparencies) / LCD Projectors
Or
Print off as hand-outs

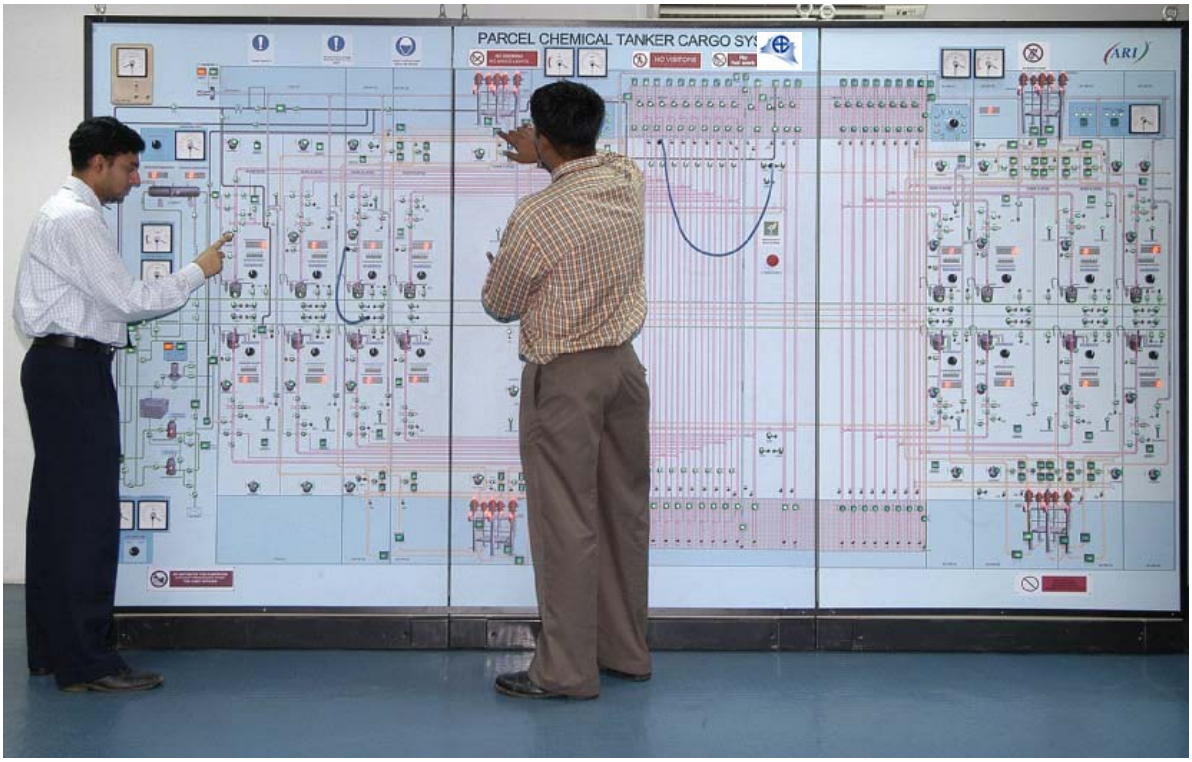


Figure 1: A simulated cargo handling plant (deck panel)

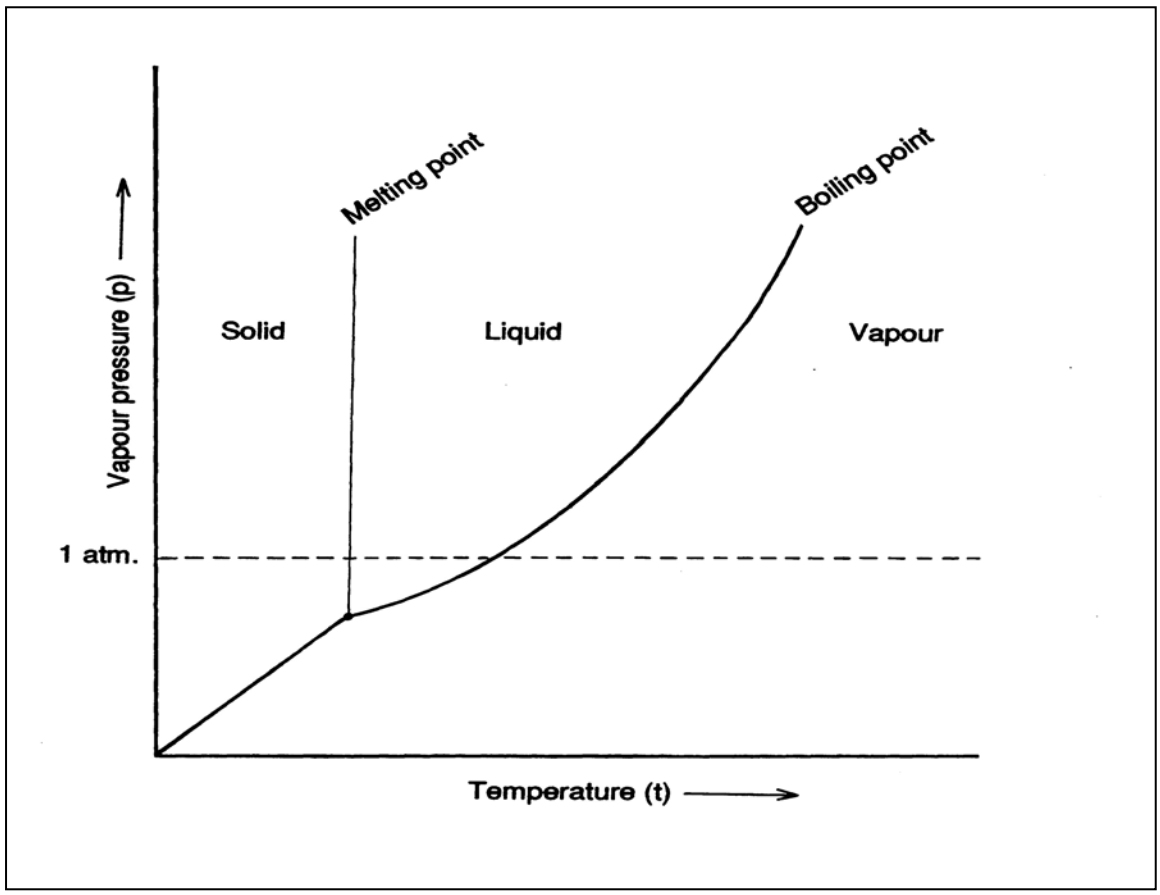


Figure 2: States of aggregation illustrated in a temperature – pressure diagram

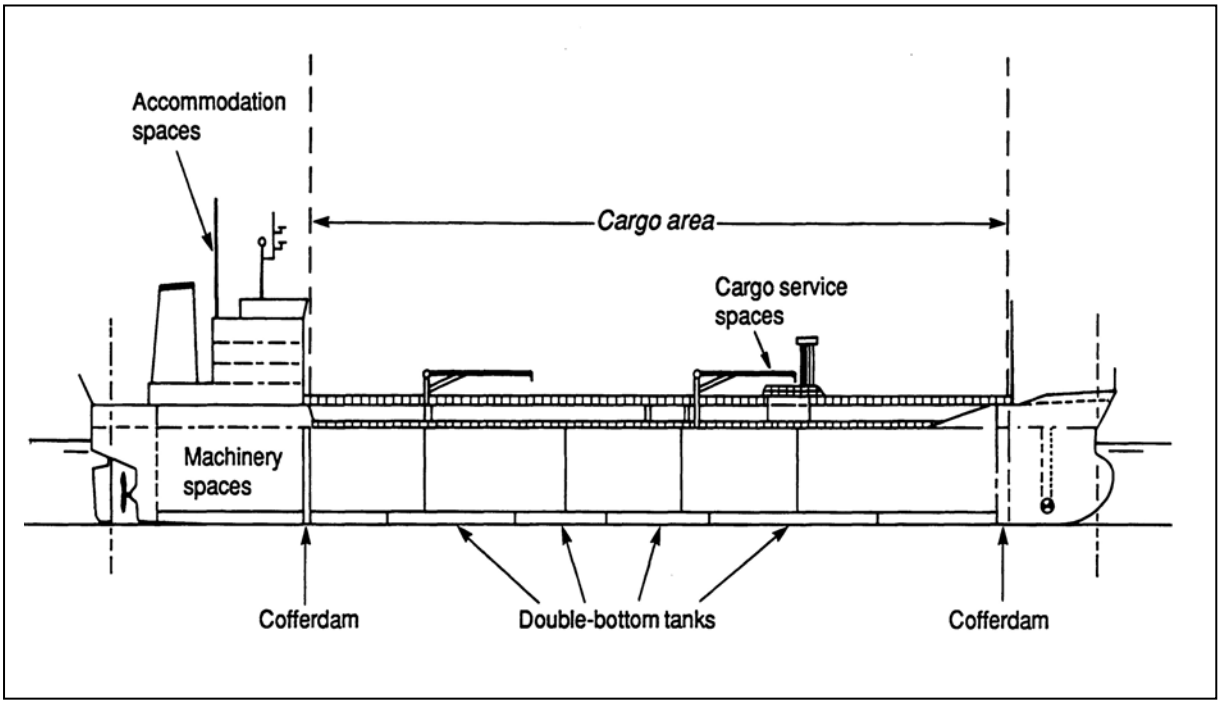


Figure 3: General Ship Arrangement

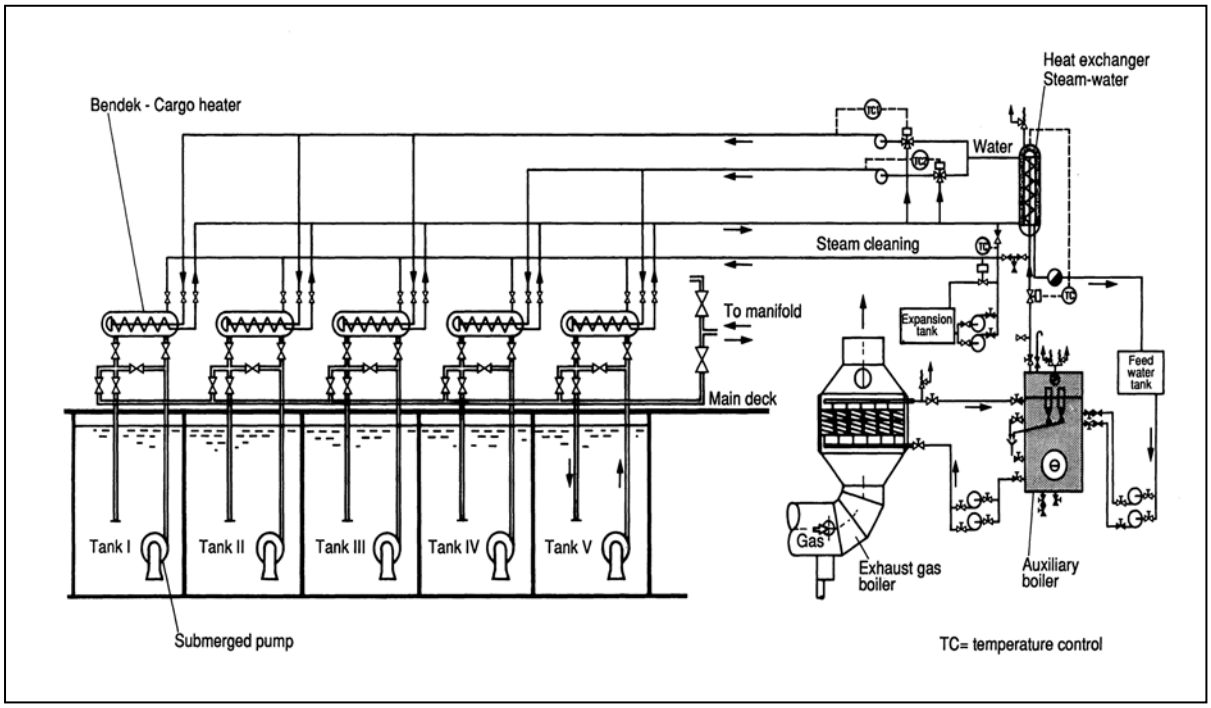


Figure 4: Diagram of cargo heating system

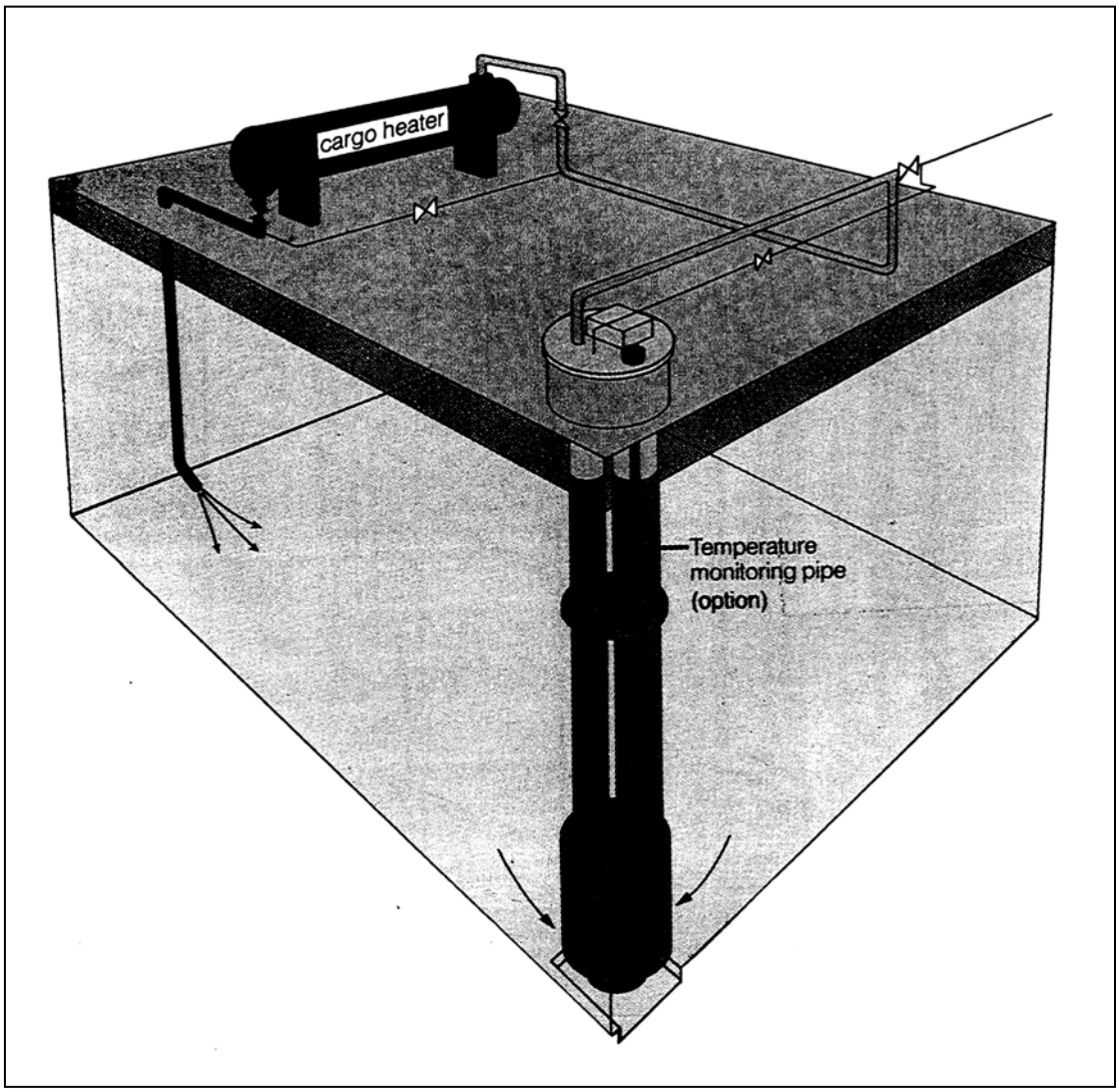


Figure 5: Cargo heating system

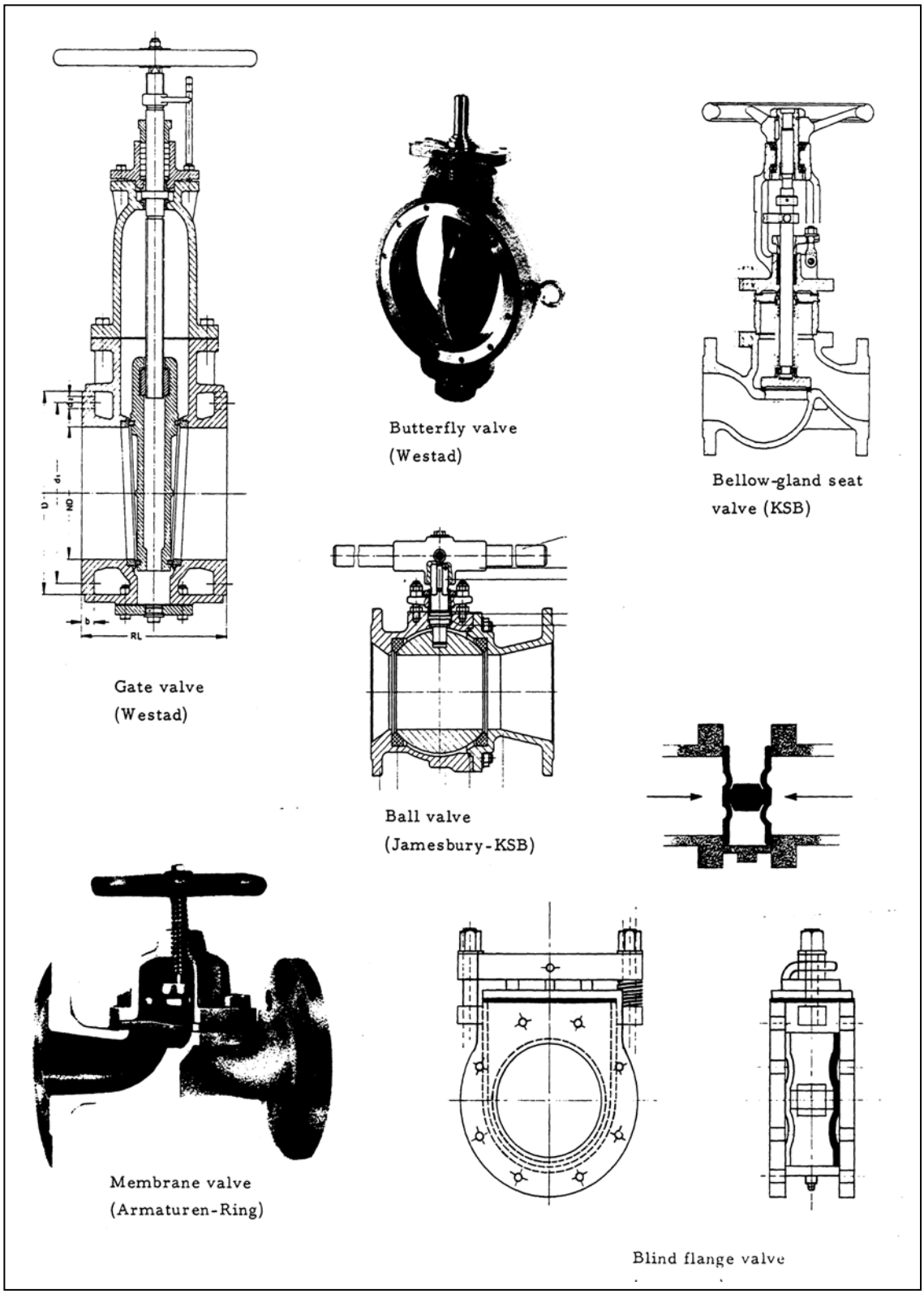


Figure 6: Valve types

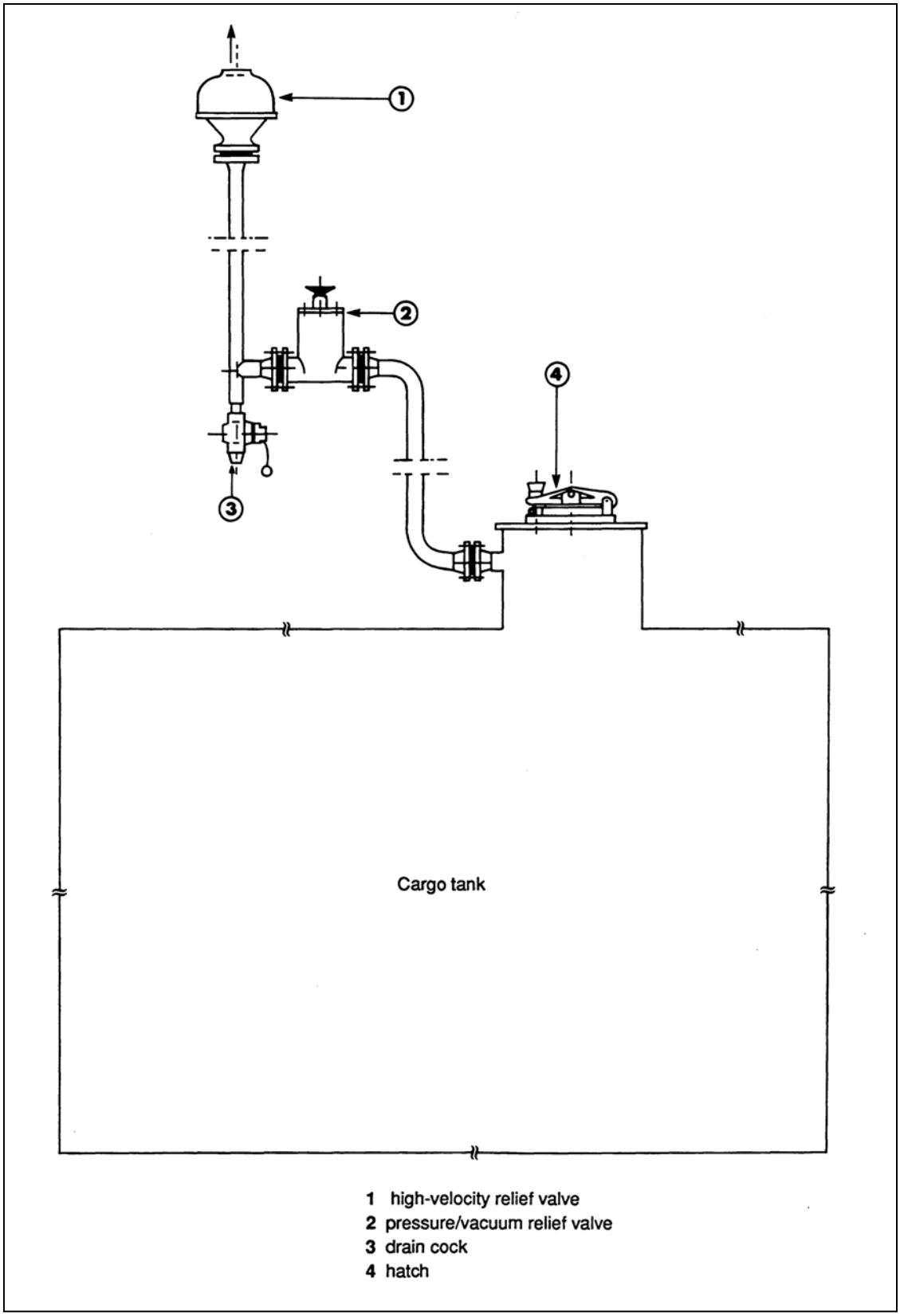


Figure 7: Cargo tank venting system

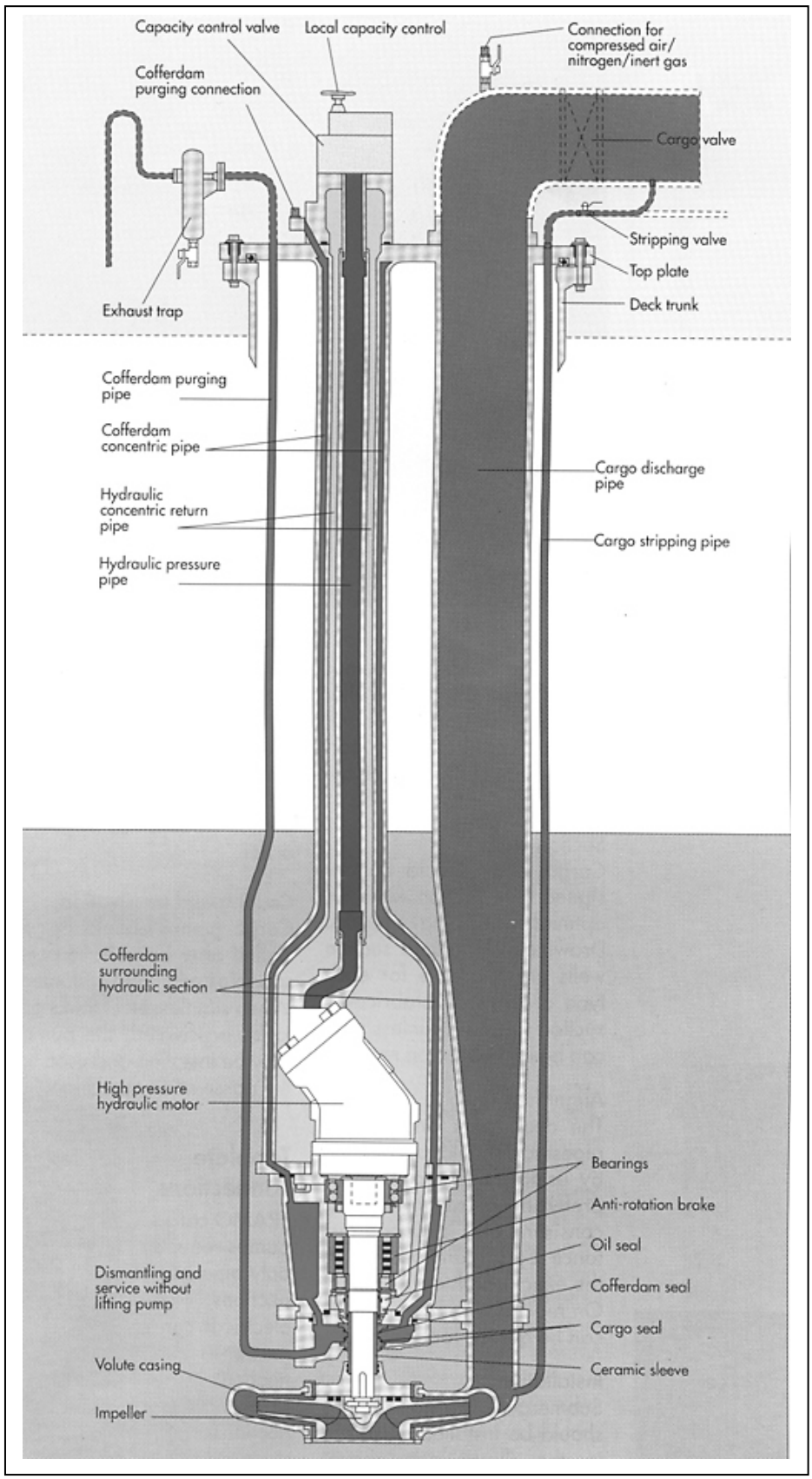


Figure 8: Submerged cargo pump

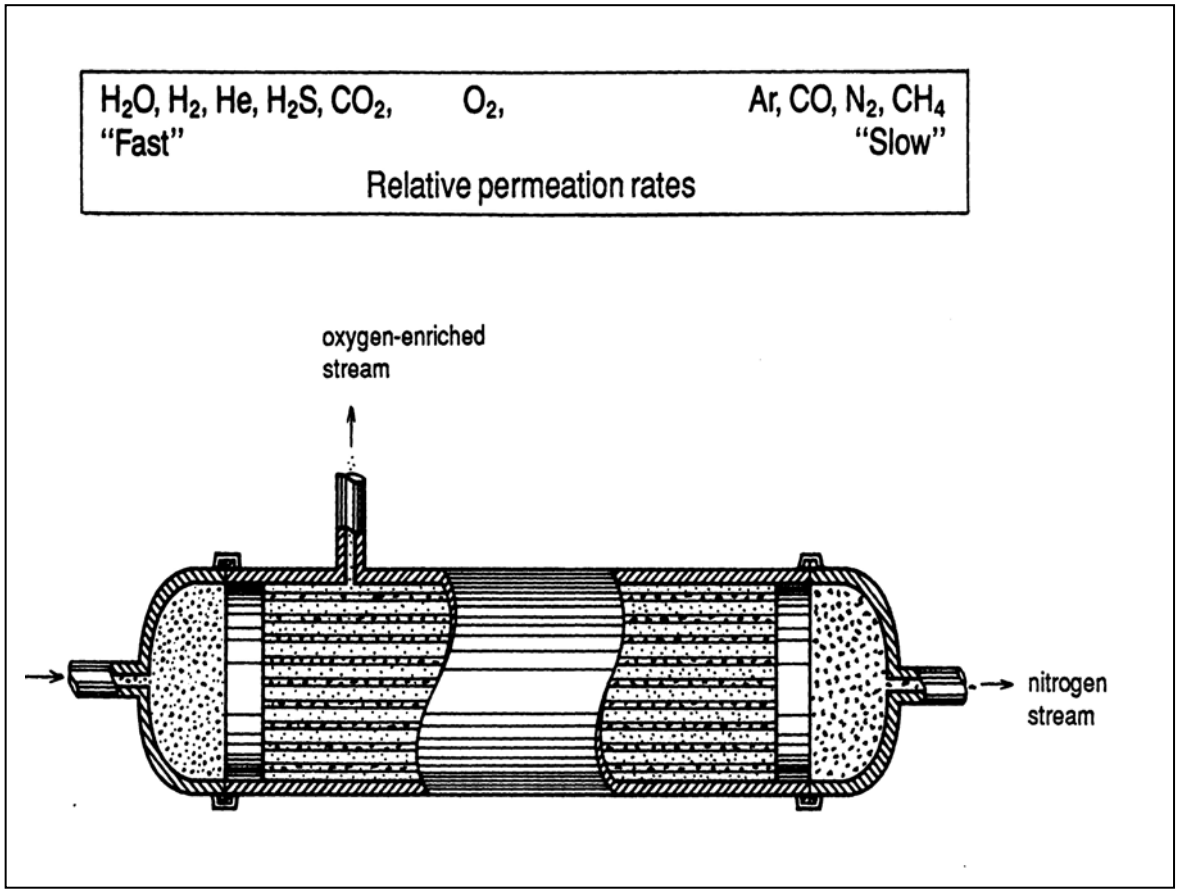


Figure 9: A system for separating nitrogen from air

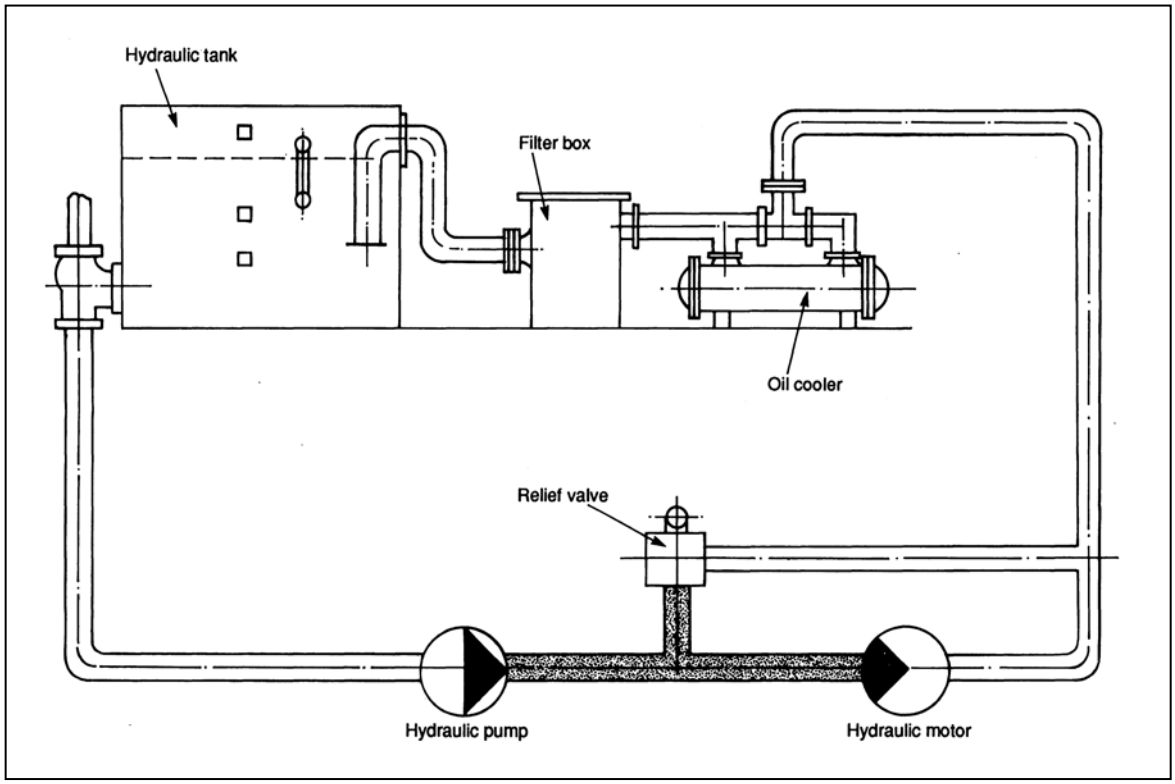


Figure 10: Cargo pump hydraulic system open system

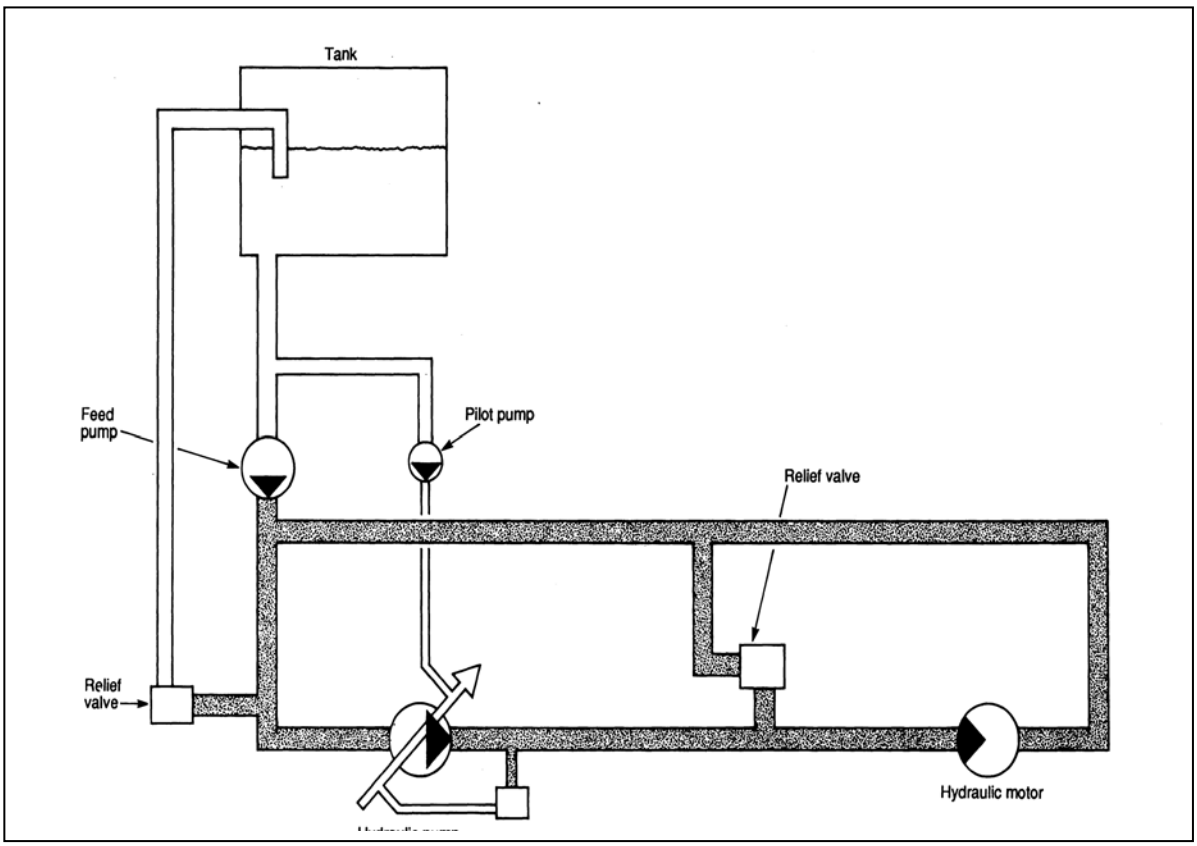


Figure 11: Cargo pump hydraulic system – variable system, closed circuit

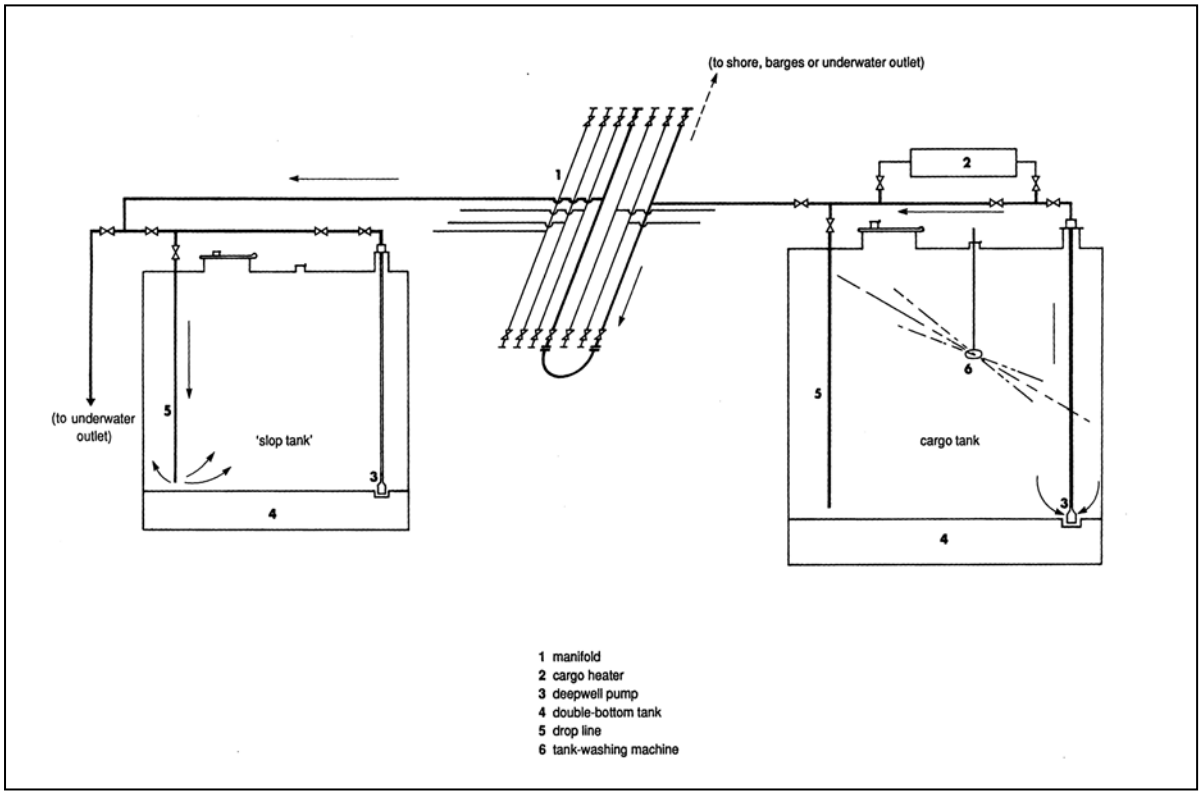


Figure 12: Tank washing and slops handling

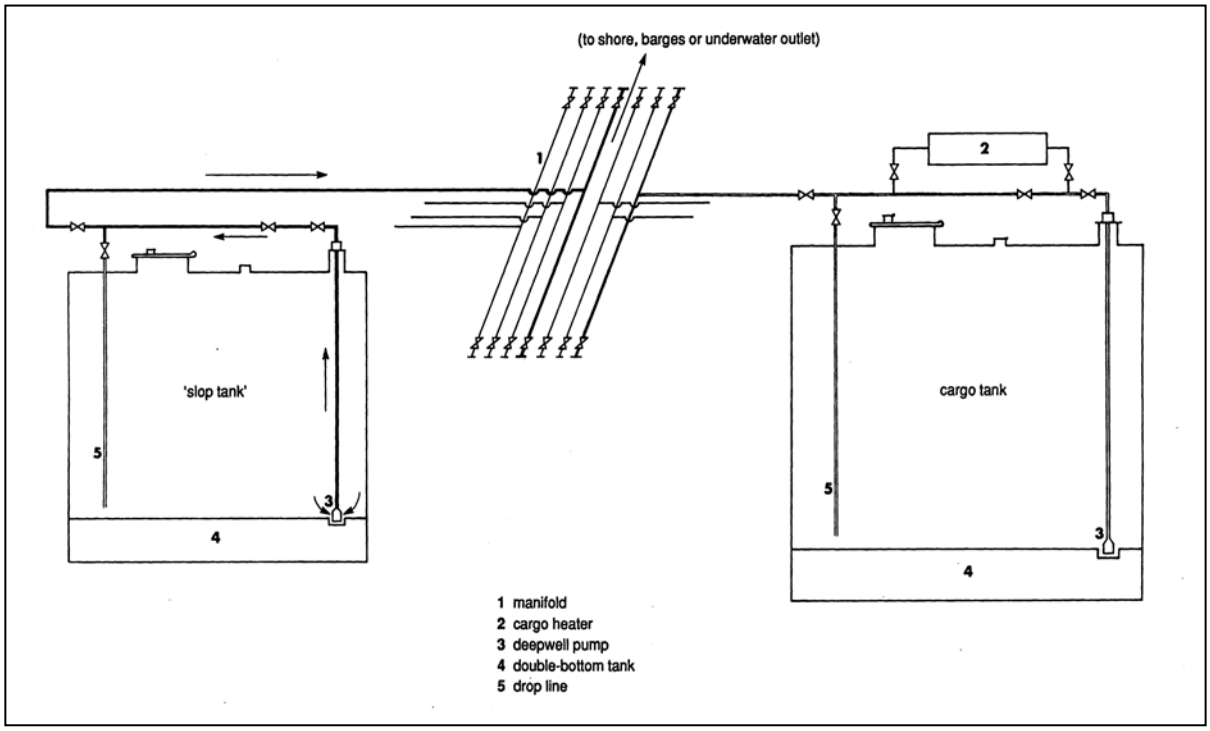
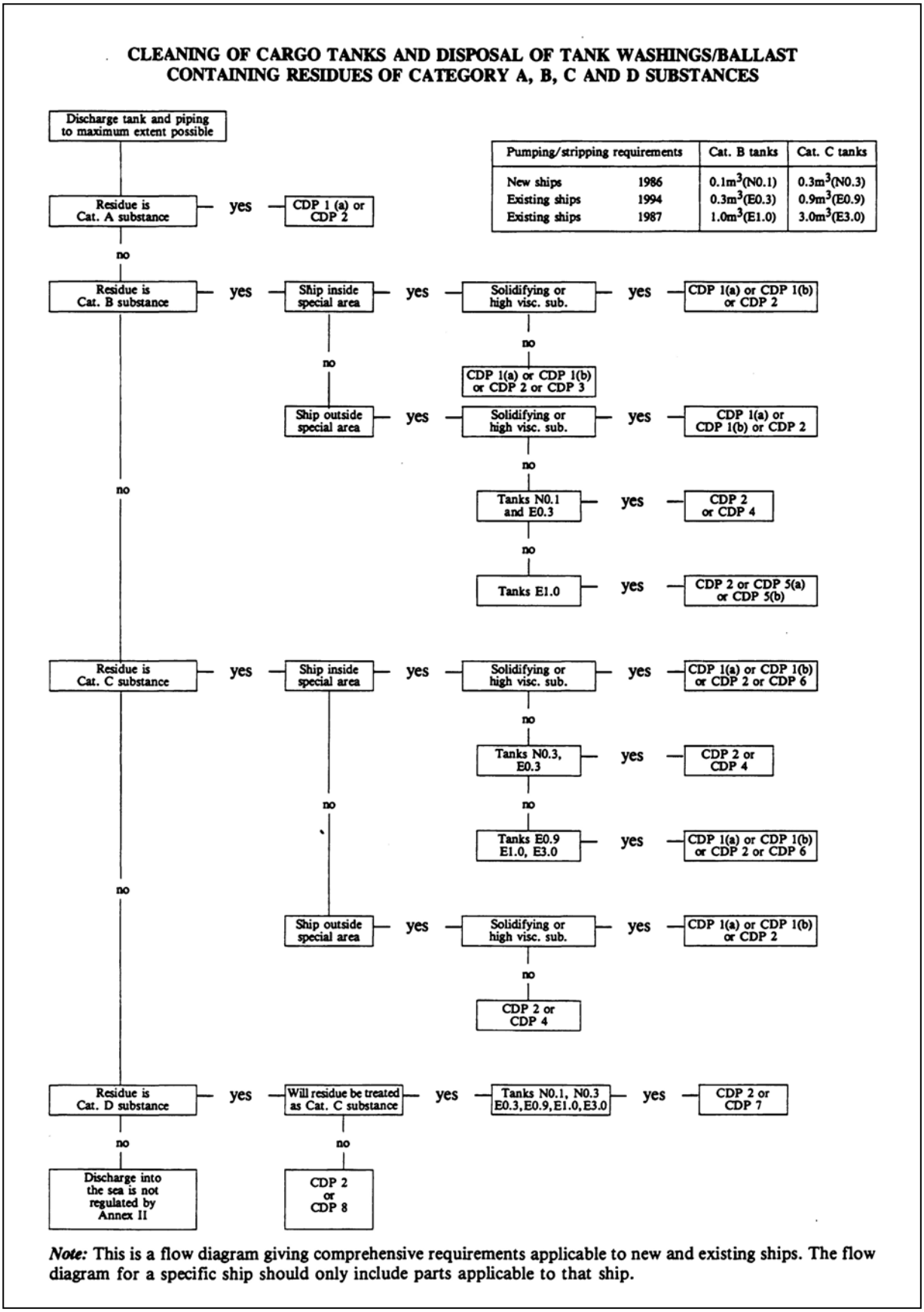


Figure 13: Disposal of slops



Note: This is a flow diagram giving comprehensive requirements applicable to new and existing ships. The flow diagram for a specific ship should only include parts applicable to that ship.

Figure 14: Cleaning and disposal procedures (CDP) flow diagram

Cleaning and Disposal Procedures (CDP)	Sequence of procedures									
	1(a)	1(b)	2	3	4	5(a)	5(b)	6	7	8
Apply prewash in accordance with appendix B and discharge residue to reception facility	×	×								
Apply prewash in accordance with appendix B and transfer residues to slop tank for discharge to sea in accordance with chapter 10, section 10.5 or 10.6						×	×			
Apply subsequent wash of minimum one cycle		×					×			
Apply ventilation procedures in accordance with appendix C			×							
Residue may be retained on board and discharged outside special area				×						
Residues of substances with viscosities <60 mPa.s at the unloading temperature may be retained on board and discharged outside special area. Alternatively, tanks may be prewashed and slops discharged ashore								×		
Dilute residue in cargo tanks with water to obtain residue concentration in mixture of 10% or less										×
Ballast tank, or wash tank to commercial requirements	×			×	×	×		×	×	
Conditions for discharge of ballast/ residue/water mixtures other than prewash:										
>12 miles from land	×	×		×	×	×	×	×	×	×
>7 knots ship's speed	×	×		×	×	×	×	×	×	×
>25 metres water depth	×	×		×	×	×	×	×		
Using underwater discharge	×	×		×	×	×	×	×	×	
Ballast added to tank		×					×			
Condition for discharge of ballasts:										
>12 miles from land		×					×			
>25 metres water depth		×					×			
Alternatively, residue/water mixtures may be discharged ashore (N.B. optional not MARPOL requirement)	×	×		×	×	×	×	×	×	×
Any water subsequently introduced into the tank may be discharged into the sea without restrictions	×	×	×	×	×	×	×	×	×	×

Note: Start at the top of the column under the CDP number specified and complete each procedure in sequence where marked ×.

Figure 15: Cleaning and disposal procedures – explanation of coded procedures

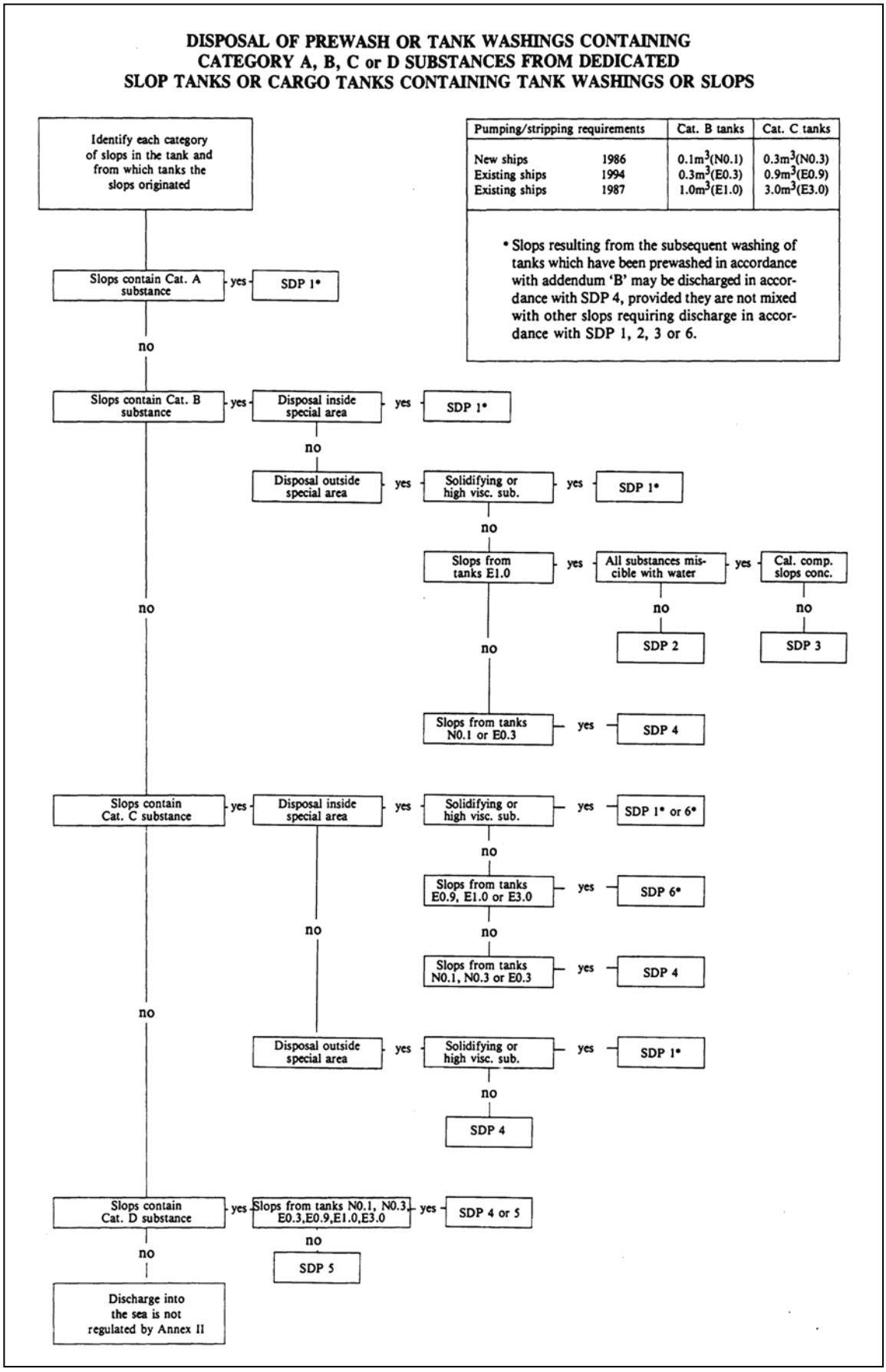


Figure 16: Slop disposal procedure (SDP) – flow diagram

Slops Disposal Procedures (SDP)	Sequence of procedures					
	1	2	3	4	5	6
Slops must be discharged ashore	×					
Establish discharge rate of immiscible residue/water mixture in accordance with addendum D		×				
Establish discharge rate of miscible residue/water mixture in accordance with addendum D			×			
The figure obtained shows the rate at which discharge is permitted		×	×			
Residues of substances with viscosities <60 mPa.s at the unloading temperature may be retained on board and discharged outside special area. Alternatively, tanks may be prewashed and slops discharged ashore						×
Dilute slops with water to obtain a solution of 10% or less – no restriction on discharge rate					×	
Discharge rate is maximum permitted by underwater discharge outlet				×		×
Additional discharge conditions						
– ship's speed at least 7 knots		×	×	×	×	×
– outside 12 miles from nearest land		×	×	×	×	×
– depth of water at least 25m		×	×	×		×
– using underwater discharge		×	×	×		×

Note: Start at the top of the column under the SDP number specified and complete each procedure in sequence where marked ×.

Figure 17: Slop disposal procedure (SDP) – explanation of coded procedures

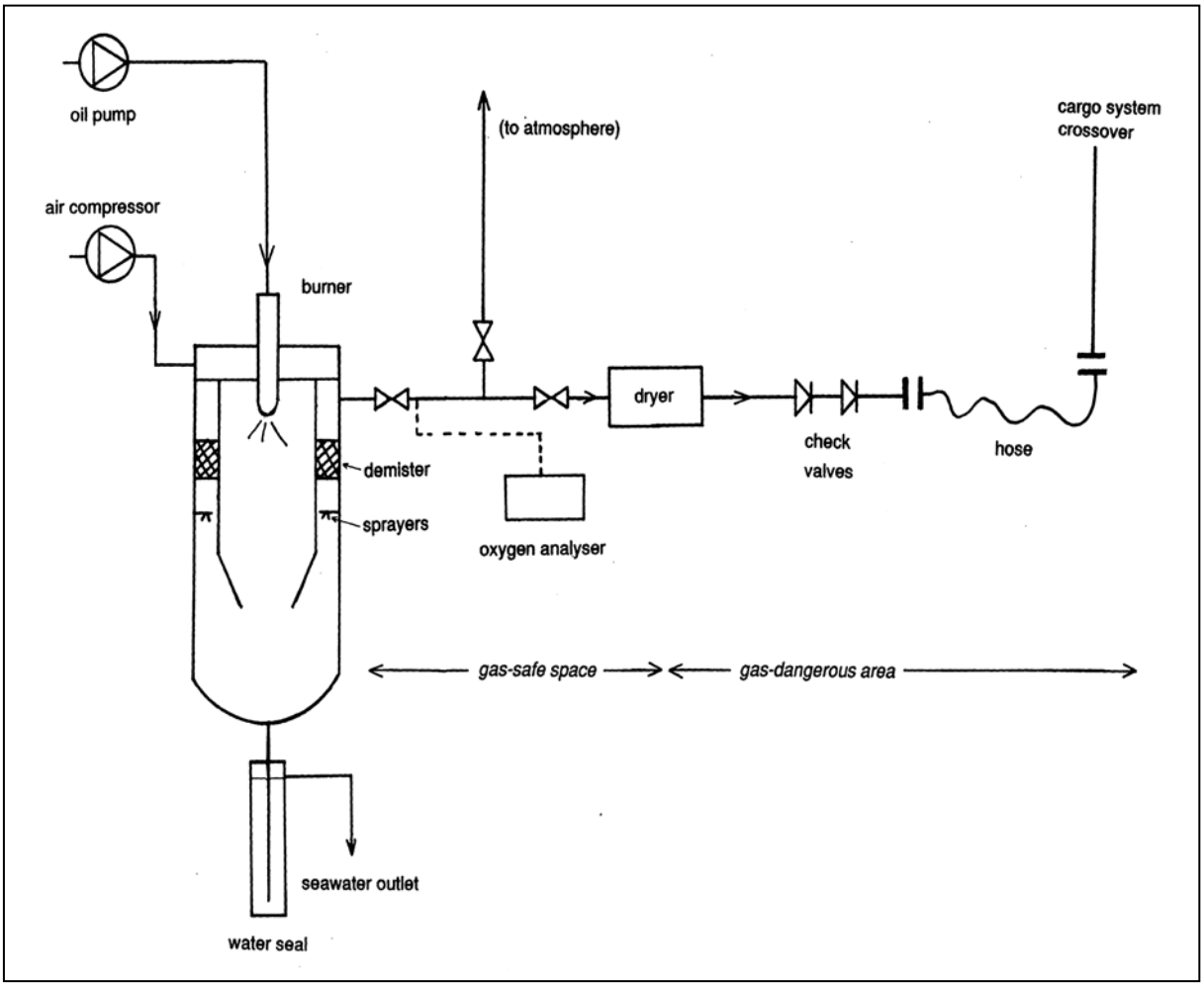
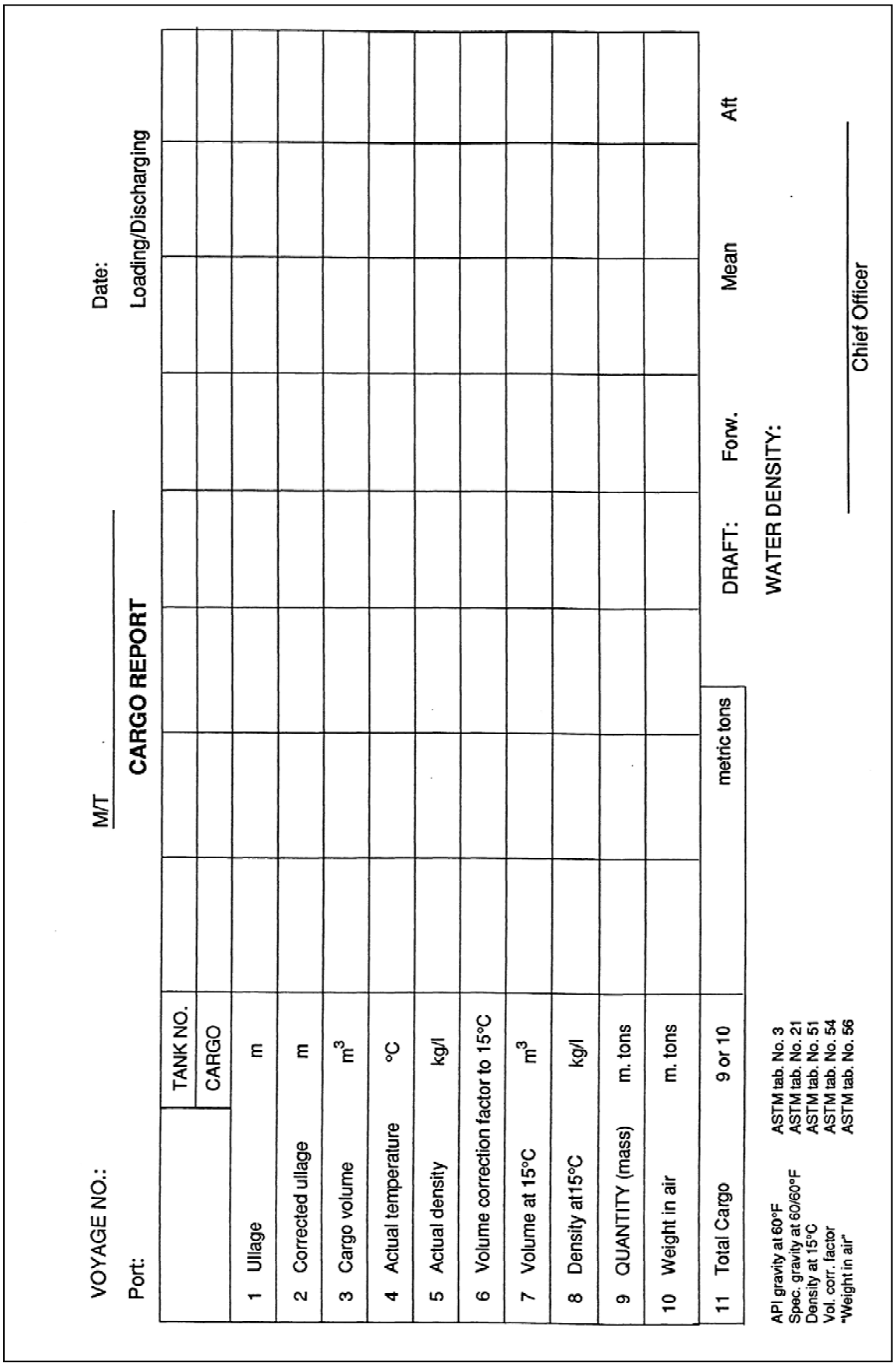


Figure 18: Simplified diagram of an inert-gas generator system



VOYAGE NO.: M/T Date:

Port: Loading/Discharging

CARGO REPORT

	TANK NO.												
	CARGO												
1 Ullage	m												
2 Corrected ullage	m												
3 Cargo volume	m^3												
4 Actual temperature	°C												
5 Actual density	kg/l												
6 Volume correction factor to 15°C													
7 Volume at 15°C	m^3												
8 Density at15°C	kg/l												
9 QUANTITY (mass)	m. tons												
10 Weight in air	m. tons												
11 Total Cargo	9 or 10												metric tons

DRAFT: Forw. Mean Aft

WATER DENSITY:

Chief Officer

API gravity at 60°F	ASTM tab. No. 3
Spec. gravity at 60/60°F	ASTM tab. No. 21
Density at 15°C	ASTM tab. No. 51
Vol. corr. factor	ASTM tab. No. 54
"Weight in air"	ASTM tab. No. 56

Figure 19: A Cargo Report Form

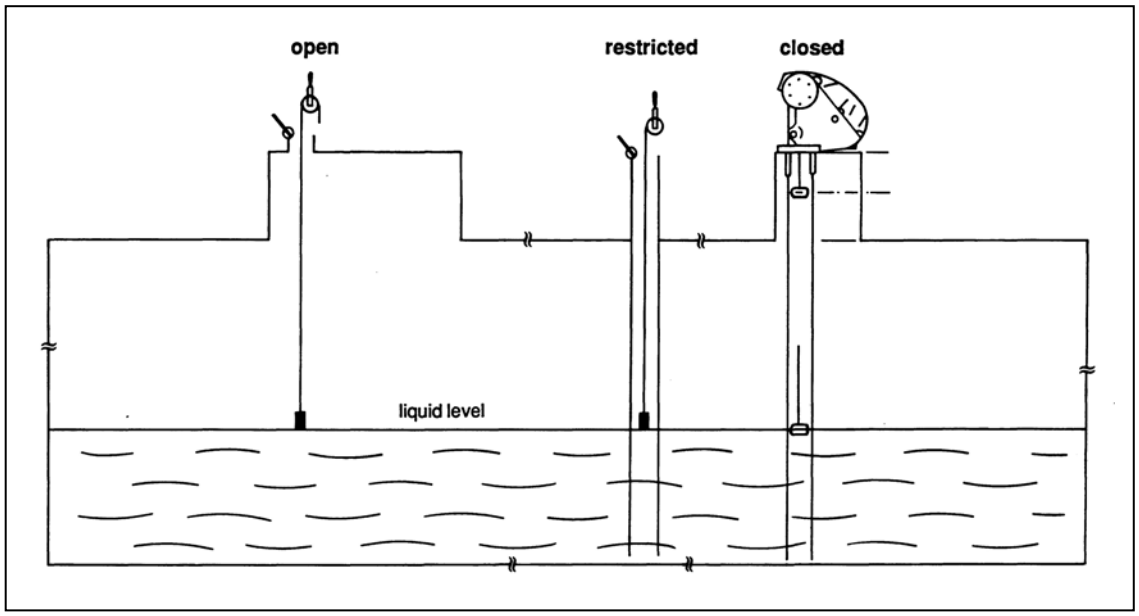


Figure 20: Types of gauging devices

Appendix

SAMPLE EXERCISE SCENARIOS

This appendix contains seven sample exercises relating to CHEMICAL cargo and ballast operations, which can be used in most designs of CHEMICAL and ballast simulator.

Exercise 1: Familiarization – Cargo Handling Simulator layout and function
This exercise can serve as an introduction to the practical tasks, making everyone familiar with the equipment, it can then develop into the preparation, start up and operations of the cargo and ballast systems.

Exercise 2: Inerting Cargo Tanks
This exercise covers inerting of cargo tanks with various atmospheres and also with chemicals.

Exercise 3: Loading Cargo
This exercise covers the setting up of loading plans, the determination of correct tank sequences, measurement of the tank atmosphere and the demonstration of skill in loading of full cargo of chemicals and topping up cargo tanks.

Exercise 4: Familiarization – Cargo Handling Simulator layout and function
This exercise covers discharging of full cargo of various chemicals and focuses on selecting the tanks to be used, taking into account the effect on hull stresses and the requirements for stability and manoeuvring.

Exercise 5: Purge and ventilation of cargo tanks for man entry.
This exercise covers purging and ventilation of cargo tanks for entry.

Exercise 6: Tank cleaning and steaming
This exercise covers tank cleaning with water, with chemicals and also with steam along with discharging and ballasting.

Exercise 7: Heating of Cargo prior discharge
This exercise covers heating of chemical cargo prior to discharging.

Exercise No.1: Familiarization Cargo handling simulator layout and functions

Duration:	3 hours
Objectives:	Understanding of the subsystems and their overall interactivity in the Chemical cargo handling simulator and the operations involved. Becoming familiar with terminology used in chemical cargo transport and operations.
Prerequisites:	The theoretical aspects of the various kinds of liquid cargo transport should be known to the trainee. Basic naval architecture related to chemical tanker will have been studied prior to simulator exercises. Basic stability, strength and stress theory will have to be known by the trainees.
Training materials:	OHP (Over Head Projector) sheets of the mimic diagrams used in the CHT (Cargo Handling Trainer) CCR (Cargo Control Room) Layout and general arrangements of the ship modelled in the liquid cargo simulator.
Simulator Condition:	Familiarization exercise enabling operations of all Chemical Tanker systems.
Briefing:	Explanation of the ship type modelled. Explanation of the various subsystems and how they interconnect in real life. Explanation of the Load Master functions, trim draft, heel indicators in the simulator.
Student action:	Attend lecture. Operate PC operate control valves, switches, gauges on pipeline panel and Familiarize with Operational equipment. Repeat previous theory learns on cargo systems, naval architecture, stability and stress.
Instructor action:	Apart from system mimics emphasize overall connection of the systems in the ship. Explain symbols used in mimics. Explain Load Master.
Debriefing:	Check if all systems understood and interconnection of systems in simulator. Discuss if relationships with previous theory are properly understood.
Evaluation:	By means of one or more diagrams have trainees show understanding of subsystems and symbols by describing system and / or indicating various symbols etc.

Exercise No.2: Inerting cargo tanks.

Duration: 3 hours

Objectives: Understanding the principles, operations and safety precautions involved with inerting of cargo tanks

Prerequisites: Introductory exercises will have been completed such as no.1. Theory of UEL, LEL and explosive mixtures will have been covered as well as explosion triangles.

Training materials: OHP sheets of the IGG system, the IG distribution lines from shore tank to ship and inerting mimics of cargo tanks.

Simulator Condition: Cargo tanks empty, filled with air. Normal ballast condition.

Student action: After checking tank atmospheres, choices to be made for which tanks to start inerting and line up.
Continuous monitoring of IG flow and O_2 content in the tanks.

Instructor action: Check choice of tanks, system used, and route chosen to tanks which are to be inerted. Check quality of IG supplied.

Debriefing: The instructor should ascertain that the tank atmospheres are at the required level of O^2.

Check that students have understood the principles of inerting and explosion levels and limits.

Evaluation: By question and answer confirm that students have understood the principles of, and reasons for, inerting of cargo - tanks.

Based on the achieved levels of IG and O_2 in the tanks, the trainees' understanding and skills in inerting can be evaluated.

Exercise No.3: Loading full cargo of various chemicals.

Duration: 6 hours

Objectives: By loading a full cargo into the ship, appreciating efficient cargo planning, stability and stress criteria and maximum allowable draft and trim.

Prerequisites: The trainees will have performed familiarization exercises on the simulator and they will have knowledge of loading zones, stability, shear forces and bending moments.

Training materials: OHP sheets of mimic diagrams of cargo deck lines, manifold connections, loading/discharge and cargo tanks.

General plan CHEMSHIP displacement scales. Loading zone chart.

Simulator Condition: Ship cargo tanks empty no ballast on board
Shore connection for 3 grades and in different group of tanks.

Briefing: Trainees should be told that all tanks are empty and no ballast for this exercise.

Tanks to be filled to 98%.

Shear forces and bending moments to be kept within limits. Preliminary check can be done by off – line Load Master. Load plan to be prepared on the Loadicator.

When loading tank gas to be vented to shore (if applicable)

Student action: Trainees can perform preliminary stress check with the Load Master.
Connection of shore manifold to be made, manifold lines with jumper connection completed and tank filling to commence simultaneously or in order according to stress limitations. When loading tanks, levels to be monitored as well as tank atmosphere and shear forces and bending movements.

Instructor action: Check loading plan and preliminary stress calculations.

Check tanks loaded in planned sequence in order to keep stresses within limits. Check tank levels after filing and topping off.

If the exercise of filing all tanks takes too long in real time, a start can be made and then continued in fast time until a further stage where slowed down as topping off of tanks is again a useful learning experience.

Debriefing: Trainees should understand possibilities and limitations of a full cargo being loaded.

Stresses and stability to be monitored and final draft, heel, tank ullages and atmosphere to be checked.

Evaluation: By means of observation of final condition assessing if trainees have reached required condition and that all values of levels, volumes, trim and list, shear force and bending moments are within the determined limits.

Exercise No.4: Discharging full cargo of various chemicals.

Duration: 6 hours

Objectives: By discharging a full cargo from the ship, appreciating efficient cargo planning, stability and stress criteria and maximum allowable draft and trim. Starting and stopping Cargo whilst delivering smaller parcels into tank trucks, barges and shore tanks

Prerequisites: The trainees will have performed familiarization exercises on the simulator and they will have knowledge of loading zones, stability, shear forces and bending moments.

Training materials: OHP sheets of mimic diagrams of cargo deck lines, manifold connections, loading/discharge and cargo tanks.
General plan CHEMSHIP displacement scales. Loading zone chart.

Simulator Condition: Ship cargo tanks full, no ballast on board
Shore connection for 3 grades and in different group of tanks.

Briefing: Trainees should be told that all tanks are loaded to 98% and ballasting to be done during unloading for this exercise.

Tanks to be unloaded with pre planned sequential quantities and pump operations to be familiarized with.

Shear forces and bending moments to be kept within limits. Preliminary check can be done by ballast conditions with off – line Load Master.

When unloading tank stripping and draining shall be carried out using special techniques (if applicable)

Student action: Trainees can perform preliminary stress check with the Load Master and prepare Discharge Plan.

Connection of shore manifold to be made, manifold lines with jumper connection completed and unloading to commence simultaneously or in order according to stress limitations. When unloading tanks, levels to be monitored as well as tank atmosphere and shear forces and bending movements frequently checked

Instructor action: Check preliminary stress calculations.

Check tanks unloaded in planned sequence in order to keep stresses within limits. Check tank ROB after unloading.

If the exercise of unloading all tanks takes too long in real time, a start can be made and then continued fast time until a further stage whereby stripping and draining of tanks is again a useful learning experience.

Debriefing: Trainees should understand possibilities and limitations of a full/part cargo being unloaded.

Stresses and stability to be monitored and final draft, heel, tank ullages and atmosphere to be checked.

Evaluation:	By means of observation of final ballast condition assessing if trainees have reached required condition of ballast water and empty tanks and that all values of levels, volumes, trim and list, shear force and bending moments were within the determined limits.

Exercise No.5: Purge and ventilate cargo tanks for entry

Duration: 3 hours

Objective: Preparing cargo tanks for entry after containing chemical cargo.

The trainee will learn how to purge cargo tanks with inert gas to safe level before starting to ventilate with air.

Prerequisites: Familiarization exercise no.1.

Inerting exercise no.2

Theory of explosion limits – LEL and UEL

Threshold Limit values (TLV)

Training material: Tank atmosphere diagrams.

Shore N_2 line up.

IG distribution diagram.

Simulator Condition: Ship ballasted to normal seagoing condition.

All cargo tanks empty.

Tank atmosphere: O_2: Nil N_2 – 99%

Briefing: The different status of the tanks to be explained to trainees.

Chemical, vapours and O_2 differences to be pointed out.

Use of IG – System, P/V valves and venting system.

Objective to maintain proper tank atmosphere composition during whole operation.

Student action: Start purging selected cargo tanks with inert gas to safe vapour concentration before starting to ventilate with air. Make one or two tanks gas free for entry.

Tank atmosphere to be constantly monitored.

Instructor action: Check that trainees observe tank atmosphere diagrams and that selected tanks are at safe levels before starting to ventilate with air.

Debriefing: Ensure trainees have understood correct use of tank atmosphere diagrams.

The importance of proper purging with IG down to safe gas concentration before ventilating with air to be stressed.

Evaluation: By means of the tank atmosphere screens, the oxygen and gas contents in the vented tanks can be monitored.

Exercise No.6: Tank cleaning with water, with chemicals and also with steam along with Discharging and ballasting

Duration: 6- hours

Objectives: By means of the exercise the relationship between the various subsystems is required to be demonstrated and the overall understanding of simultaneously discharging, ballasting and Tank Cleaning to be demonstrated and realized.

Prerequisites: Familiarization exercises.

Discharging exercises.

Ballasting exercise

IG usage exercise

Theoretical knowledge of shear force, stress, trim, heel is required.

Pollution prevention rules and procedures have been discussed..

Training materials: Mimic diagram of cargo tanks.

Cargo pump operation technique (FRAMO)

Shear force, bending moment.

IG system.

Simulator Condition: Cargo tanks loaded with 3 grade of chemical parcel.

No ballast.

Briefing: The trainees should be convinced of the complexity of the exercise, which should be built up step by step.

Discharging to be started first. Followed with Ballasting and then Tank cleaning.

Stress, trim and heel to be monitored.

Discharging, Tank cleaning and ballasting according to pre – prepared plan.

Student action: The trainees will start with preparing a discharging and Tank cleaning plan, which will keep stress, trim and heel within the acceptable limits.

Discharging, chemical tank cleaning, ballasting and stripping will take place simultaneously.

In this order operation will continue until all tanks empty,

Ballasted according to IMO requirements.

Instructor action: The instructor should ascertain that the choice of discharging order takes stress, trim and heel into consideration.

During discharging the tank atmosphere are monitored and inert gas supplied.

That tank cleaning commences after completely unloading the tank, Ballasting commences when ship becomes too light or has excessive trim, heel or stress.

As the exercise includes several aspects and comprises of a full cargo operation, breakdown in separate sessions is possible or alternatively routine parts can be run in fast by the instructor if the trainees have started up the sub- processes properly.

Debriefing: By means of discussion bring up problems in operations and problems due to complexity.

Check which order tanks have been handled and in which order ballast has been loaded.

Check how much ballast has been loaded in order to create suitable draft, trim and heel.

Evaluation: By mean of question and answer determine understanding of multiple operations.

Time needed to complete operations will be a measure of efficient conduct of operations.

All cargo should be discharged, tanks Washed and inerted.

Ship should be ballasted as light as possible allowing for proper draught, trim, heel and stress.

Exercise No.7: Heating Cargo prior Discharging

Duration:	3 hours
Objective:	Demonstrate the use of Cargo heating equipment, Prepare for discharging.
Prerequisites:	Familiarization exercise no.1. Inerting exercise no.2 Discharging Exercise no. 4 Basic thermodynamics and cargo heating principles.
Training material:	Tank Cargo diagrams. Steam boiler diagram User manual
Simulator Condition:	Cargo tanks full multiple cargoes, slop tanks, if present, empty or any 2 nos. tanks empty. Cargo temperature 40^0C Seawater temp 30^0C.
Briefing:	The different status of the tanks to be explained to trainees. States the precautions with Toxic and polymerisable cargoes. States the temperatures available and required. High Level alarm precautions to be explained.. Dangers of overheating. P/V valves and venting system.
Student action:	By means of a heating line students shall heat cargoes and circulate them for uniform heating, to the special requirements of the shipper Dangers of overheating Tank Levels to be constantly monitored for risk of overflow.
Instructor action:	Adjust Cargo tank temperatures. Check trainees perform heating in accordance with permissible patterns.
Debriefing:	Ensure trainees have understood need of cargo heating. The importance of proper gradual heating to be stressed.
Evaluation:	By means of question and answers during debriefing students efforts can be monitored. To reach the desired temperatures. Alarm Logs to be monitored that temperatures have not been exceeded.

GUIDELINES FOR COMPLETING THE CHEMICAL CHECKLIST - LOADING

1. Material Safety Data Sheet

Information on the product(s) to include:

- ✓ Full description of the physical and chemical properties, including reactivity, necessary for the safe containment of the cargo.
- ✓ A cargo stowage plan *(Cargo/Tank coating compatibility)*
- ✓ Action to be taken in the event of spills or leaks
- ✓ Counter measures against accidental personal contact
- ✓ Fire-fighting procedures and fire-fighting media
- ✓ Procedures for cargo transfer
- ✓ When product(s) requiring to be stabilized or inhibited are to be handled, information is exchanged thereon

2. Protective equipment

- ✓ Protective equipment including SCBA and protective clothing appropriate to the specific dangers of the product(s) handled, shall be readily available in sufficient number for operational personnel both on board and ashore.
- ✓ Protected storage places be clearly marked.
- ✓ Physically fit and trained personnel selected to use SCBA.

3. Counter measures against personal contact

- ✓ The medical chest is readily available
- ✓ Information on how to handle contacts giving regard to the special properties of the product(s) shall be studied and available for immediate use.
- ✓ Antidote(s) for immediate use and/or suitable counter-measures to be taken to limit the consequences of the spilled product(s) on human beings are available
- ✓ Suitably marked decontamination showers and an eye wash are available on deck at convenient locations. The showers and eye wash are operable in all ambient conditions
- ✓ Shower and eye wash water is maintained at a safe temperature

4. Automatic shut down system

- ✓ Cargo handling rate to be adjusted to avoid pressure surge evolving from the automatic closure.
- ✓ Alternative means may be fitted to relieve the pressure surge.

5. Gauges and alarms

- ✓ System gauges to be regularly checked
- ✓ Alarms set to different levels when possible

6. Vapour detection instruments

- ✓ Equipment capable of measuring where appropriate, flammable and/or toxic levels.

- ✓ Instruments capable of measuring flammability should be calibrated before operations.

7. Fire-fighting media and procedures

- ✓ Exchange of information with regard to procedures to be followed if a fire does occur.
- ✓ Special attention to products which may be water reactive .

8. Transfer hoses material

- ✓ Hoses indelibly marked with maximum working pressure, test pressure and last date of test at this pressure, and if used at service temperatures other than ambient, its maximum and/or minimum service temperature

9. Pipeline systems

- ✓ During cargo operations where the use of portable cargo lines on board or ashore is unavoidable, care should be taken to ensure that these lines are correctly positioned and assembled so that no additional danger exists from their use. Where necessary, the electrical continuity of these lines should be checked.

10. Warning signs

- ✓ The Dangerous Chemicals and Noxious Liquid Substances Regulations require the notice to be displayed near every access to the ship

11. Operation manuals

- ✓ Procedures and arrangements manual
- ✓ The Dangerous Chemicals and Noxious Liquid Substances Regulations require the BCH / IBC Code to be on board

BULK LIQUID CHEMICAL CHECKLIST

Nr	Item	REC	CODE	Remarks
1.	Is information available giving the necessary data for the safe handling of the cargo, and, where applicable, a manufacturer's inhibition certificate?			
2.	Is sufficient and suitable protective equipment (including self-contained breathing apparatus) and protective clothing ready for immediate use?			
3.	Have counter measures against accidental personal contact with the cargo been agreed?			
4.	Is the cargo handling rate compatible with the automatic shutdown system, if in use?			

Nr	Item	REC	CODE	Remarks
5.	Are cargo system gauges and alarms correctly set and in good order?			
6.	Are portable vapour detection instruments readily available for the products to be handled?			
7.	Has information on fire fighting media and procedures been exchanged?			
8.	Are transfer hoses of suitable material resistant to the chemical action of the cargoes?			
9.	Is cargo handling being performed with portable pipelines?			
10.	Is "Warning Hazardous Chemical" sign posted?			
11.	Are the required operation manuals available at hand?			

Note : Codes as per ISGOTT
REC - Record to be maintained

Part E: Evaluation

1 Introduction

The effectiveness of any evaluation depends on the accuracy of the description of what is to be measured.

The learning objectives that are used in the detailed teaching syllabus will provide a sound base for the construction of suitable tests for evaluating trainee progress.

2 Method of evaluation

The methods chosen to carry out an evaluation will depend upon what the trainee is expected to achieve in terms of knowing, comprehending and applying the course content.

The methods used can range from a simple question-and-answer discussion with the trainees (either individually or as a group) to prepared tests requiring the selection of correct or best responses from given alternatives, the correct matching of given Items, the supply of short answers or the supply of more extensive written responses to prepared questions.

Where the course content is aimed at the acquisition of practical skills, the test would involve a practical demonstration by the trainee making use of appropriate equipment, tools, etc.

The responses demanded may therefore consist of:

- the recall of facts or information, by viva-voce or objective tests
- the practical demonstration of an attained skill
- the oral or written description of procedures or activities
- the identification and use of data from sketches, drawings, maps, charts, etc.
- carrying out calculations to solve numerical problems
- the writing of an essay or report.

3 Validity

The evaluation must be based on clearly defined objectives, and it must truly represent what is to be measured. There must be a reasonable balance between the subject topics involved and also in the testing of trainees' KNOWLEDGE, COMPREHENSION and APPLICATION of concepts.

The time allocated for the trainee to provide a response is very important. Each question or task must be properly tested and validated before It is used to ensure that the test will provide a fair and valid evaluation.

4 Reliability

To be reliable, an evaluation procedure should produce reasonably consistent results no matter which set of papers or version of the test is used.

5 Subjective testing

Traditional methods of evaluation require the trainee to demonstrate what has been learned by stating or writing formal answers to questions.

Such evaluation is subjective In that It invariably depends upon the judgment of the evaluator. Different evaluators can produce quite different scores when marking the same paper or evaluating oral answers.

6 Objective testing

A variety of objective tests have been developed over the years. Their common feature Is that the evaluation does not require a judgment by the evaluator. The response is either right or wrong.

One type of objective test involves supplying an answer, generally a single word, to complete the missing portion of a sentence. Another involves supplying a short answer of two or three words to a question. Such tests are known as ‘completion tests’ and ‘short answer tests’.

Another form of objective testing consists of ‘selective response tests’ in which the correct, or best, response must be selected from given alternatives. Such tests may consist of ‘matching tests’, in which items contained in two separate lists must be matched, or they may be of the true/false type or of the multiple-choice type.

The most flexible form of objective test is the multiple-choice test, which presents the trainee with a problem and a list of alternative solutions, from which he must select the most appropriate.

7 Distracters

The incorrect alternatives in multiple-choice questions are called ‘distracters’, because their purpose is to distract the uninformed trainee from the correct response. The distracter must be realistic and should be based on misconceptions commonly held, or on mistakes commonly made.

The options “none of the above” or “all of the above” are used in some tests. These can be helpful, but should be used sparingly.

Distracters should distract the uninformed, but they should not take the form of ‘trick’ questions that could mislead the knowledgeable trainee (for example, do not insert “not” into a correct response to make It a distracter).

8 Guess factor

The 'guess factor' with four alternative responses in a multiple-choice test would be 25%. The pass mark chosen for all selective-response questions should take this into account.

9 Scoring

In simple scoring of objective tests one mark may be allotted to each correct response and zero for a wrong or nil response.

A more sophisticated scoring technique entails awarding one mark for a correct response, zero for a nil response and minus one for an incorrect response. Where a multiple-choice test Involves four alternatives, this means that a totally uninformed guess involves a 25% chance of gaining one mark and a 75% chance of losing one mark.

Scores can be weighted to reflect the relative Importance of questions, or of sections of an evaluation.

Information Requested of Instructors Who Implement IMO Model Courses

Introduction

1. IMO model courses are periodically revised to take into account the changes which have taken place in relevant Conventions, resolutions and other matters affecting each course. To help lMO to improve the content of courses when they are revised, the assistance of all instructors who implement or participate in implementing courses is requested, whether the implementation Is part of an IMO technical co-operation project or part of a Maritime Training Academy's regular programme.

Information requested and its format

2. To simplify their consolidation by IMO, the technical comments and suggestions for the Improvement of model courses should follow the format that Is outlined below. If no comments or suggestions are to be provided under a topic, please Insert "no comment" against the Item.

3. Please identify:
   .1 the course number and title;
   .2 the date and location of its implementation;
   .3 the approximate number of IMO model courses you have implemented to date; and
   .4 the approximate number of times you have Implemented this particular model course.

4. In commenting on Part A — Course Framework, please comment on the Items ('Scope', 'Objectives', etc.) in the order In which they appear In the course; In all cases, please Indicate:

   .1 the number of participants who met the entry standards and the number who did not;
   .2 the course intake and, if the recommendations In 'Course Intake limitations' were exceeded, the reasons for this and your observations on the effect of this on the qualify of the course;

.3 If the conditions under ‘Staff requirements’ were met; If not, please Indicate the nature of the deficiency and give your observations of the effect of this on the quality of presentation of the course; and -

.4 any lack of equipment or facilities as compared with the recommendations under ‘Teaching facilities and equipment’ and your observations of the effect of this lack on the quality of presentation of the course.

5. In commenting on Part B — Course Outline, please bear in mind that minor variations In time allocations are Inevitable. Major difficulties with allocations of time and any omissions or redundancies of subject areas should be briefly explained.

6. In commenting on Part C — Detailed Teaching Syllabus, please identify the specific learning objectives concerned by their paragraph numbers.

7. In commenting on Part D — Instructor’s Manual, please clearly identify the section concerned. If the bibliography or the practical exercises are found to be unsatisfactory, please

Identify suitable alternative texts, as far as is possible, or outline alternative exercises, as appropriate.

8. Any further comments or suggestions you may have which fall outside the scope of the items listed above may be added at the end. In particular, your views on the usefulness of the course material to you in implementing the course would be appreciated, as would the contribution to IMO of any additional teaching material you found useful in implementing it.

Please address your comments to:

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