Cargo Handling Trainer

CHT2000-VLCC-II-ws

USER'S MANUAL

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Chapter 1

Introduction

1. INTRODUCTION

The last few years have seen the beginning of a drastic change in the education of ships officers. Due to new International and National Rules and Regulations the demand for more safe cargo handling has increased. At the same time new technology has made more advanced training simulators available at an affordable price.

The purpose of Kongsberg Norcontrol´s Cargo Handling Trainer (CHT2000-VLCC-II-ws) is to provide an educational tool that gives a realistic reproduction of the dynamic behaviour of a typical VLCC cargo handling system and reflects the interactions between the different auxiliary systems.

A well- designed computerised simulator will, to a great extent, give the same training facilities, which means training in the normal operation of a shipís cargo handling system.

In addition to giving the students operational training, CHT2000-VLCC-II-ws is also a tool for more intimate theoretical studies for loading/discharging operations, such as:

- Planning the operations by using CHT2000-VLCC-II-ws as a load computer
- Run test conditions on the loading computer
- Studying single components
- Studying tank atmosphere
- Studying inert gas in relation to boiler load
- Monitoring the discharge cost and time
- Provide training in operations that the officers will have benefit of later on
- Shows you the results of incorrect operations without damaging the equipment
- Presents all relevant terminology and relates it to associated hardware
- Demonstrates both theoretical aspects and practical results in one and the same room.

1.1 Concept Description

The CHT2000-VLCC-II-ws is based on the simulator design- and development- system, Operator Training Simulation System (OTISS) developed by Special Analysis and Simulation Technology Ltd. (SAST) UK.

The Operator Man-Machine Interface (MMI) is realised using the EMULA Graphic software Package developed by Institutt For Energiteknikk (IFE) Halden, Norway.

The CHT2000-VLCC-II-ws system is implemented on a network of Hewlett-Packard 9000 series computers. The structure of the system is outlined in the following illustration.

By the simulation of faults and deteriorationís, the instructor can create a training situations that enables the trainee to meet and overcome these problems. This training environment will give the students experience in dealing with problems that would normally demand years of seagoing experience.

The third part of the simulator is the instructorís station which includes the "simulator controls" for:

- Changing operational and ambient conditions
- Setting faults and deteriorationís, single or in series
- Simulate leaks in cargo lines and tank bulkheads
- Resetting faults
- Logging events and alarms
- General system communication

The CHT2000-VLCC-II-ws is designed to train students in cargo handling operation under both normal and abnormal conditions. It is therefore of utmost importance that the training takes place in a realistic environment.

To get a true impression of how to run cargo plant , the disturbing noise is essential, therefore KONGSBERG NORCONTROL has designed a unique synthesised audio system. Pump sounds are synchronised with the rpm of the cargo pumps and in addition the noises from diesel engines, generators, compressors, etc. are presented by separate sound amplifiers.

1.2 System Description

As pioneers in the ship automation field, KONGSBERG NORCONTROL Systems a.s., know how modern technology has improved safety, reliability and economy on board ship.

The improvement has been immense, but it is also known that it is impossible to replace the proficiency and know how to an experienced engineer, the man who must be present in the right place at the right time to do things quickly and efficiently.

KONGSBERG NORCONTROL Systems has designed a dynamic real-time computerised simulator which can compress years of experience into a few weeks, and provides hands-on training.

The simulator provides the necessary information on dynamic and interactive processes as found in a real cargo plant.

The CHT2000-VLCC-II-ws is designed to meet the demands for basic operational training of junior officers, fault studies with economy and optimisationís studies with the senior officers. It enables the simulation of individual auxiliary systems (sub-system) and independent components as well as an efficient simulated presentation of a total plant.

KONGSBERG NORCONTROL Systems CHT2000 includes a comprehensive instructor communication link that allow him to:

- Pre-program and store situations.
- Develop and test new training programs.
- Change operational and ambient conditions.
- Freeze current situations for discussions and clarifications with the trainees.
- Setting of single faults or automatic sequential fault.

The CHT2000 has a layout and instrumentation typical to that of a modern vessel.

1.3 Simulator Configuration

The CHT2000 Simulator is implemented on a network of UNIX workstations with an Instructor Station used as a common server. The network is an Ethernet (protocol UDP/IP) and the server is equipped with a hard disk storage of 1.0 Gb. Data Tape Station is provided for taking back-up of the System Software

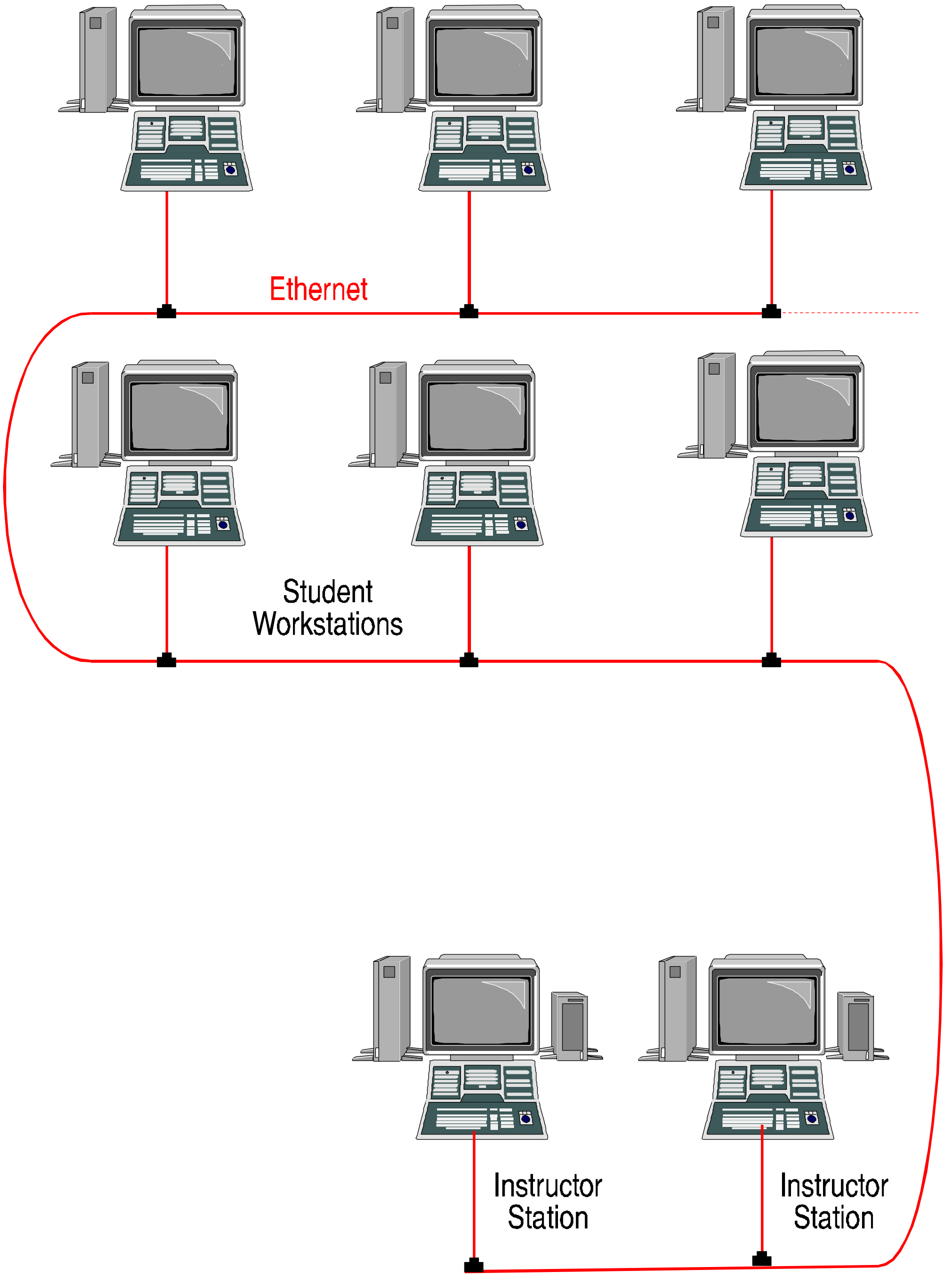


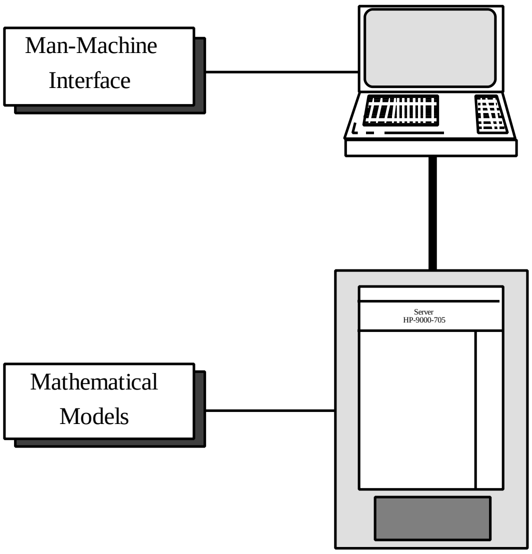
Figure 1-1 Computer Configuration

1.4 Simulator Concept

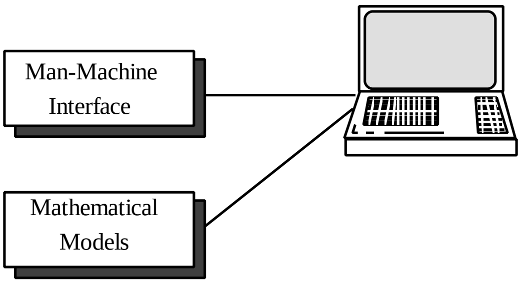
The OTISS-/EMULA- environment is very flexible. The mathematical models and the man-machine interface are run as separate programs. The communication between them is established by UNIX sockets. The program running the mathematical models of the simulated process is called OTISS. The Man.Machine Interface program, EMULA, is driving the graphic pictures, and installed individually on each workstation. The OTISS-program can run on any of the involved computers. When it is running on the server, the instructor can connect selected workstations for monitoring of the process by the students.

When more than one EMULA station is connected to one OTISS program, the actions taken at one station will influence the shared process and the changes are observed on all the workstations. This way of running the simulator is controlled by the instructor to avoid chaos if different operators take inconsistent actions

The simulator is run in one of two modes, as shown in figure 2.



Full Simulation Mode



Part Task Simulation Mode

In the **full simulation mode,** the OTISS-program is run on the server, and the instructor can select each workstation in the workstation room to be connected to the simulation..

In **part task simulation mode**, the workstations are isolated from each other. The OTISS-program and the EMULA-program will run on each workstation.

This mode is normally used for detailed studies of sub-systems of the simulator.

Each workstation is also capable of running the complete simulation model i.e. several workstations can control the simulation without interference with the others. Independent of what simulation mode is used, the workstations need access to the harddisk.

Figure 1-2 Simulator Concepts

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Chapter 2

Technical Specification

2. TECHNICAL SPECIFICATION

2.1 Workstation HP 9000 / 425e

The Hewlett Packard Workstations has the following specifications:

HP-9000/425e Workstation

Name	**Type 425e**	**Description**
Processor	MC68040	
CPU Clock	25 Mhz	
Memory	16Mb	ECC RAM (Error Control Correction)
Monitor	16" Colour monitor	Resolution 1280 ∗ 1024
Interface	SCSI and LAN	Both plus 1 RS-232 Interface
Performance	22 MIPS 2,6 MFLOPS	Million Instructions pr.sec. Million floating point operations pr.sec.

All data according to HP technical specification

2.2 Server HP C 3020 T

The Host Computer (mathematical model computer) is a Hewlett Packard server. Together with distributed microprocessors it forms the complete trainer computer system. The microprocessors are located in workstatios and intelligently interfaced to the Host Computer via Ethernet

Name	**Type C 3020 T**	**Description**
Disc	1,0 Gb SCSL	Hard Disc
Back-up	2,0 Gb	Digital Data Storage (Tape)

All data according to HP technical specification

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Chapter 3

Installation

3. INSTALLATION

3.1 Introduction

The purpose of this chapter is to provide facility guide-lines for installation of the simulator. Consistent and reliable performance of the system is dependent on a proper environment including power conditioning, air flow, cooling and humidity control as well as installation of the system in conformance to standards. Achievement of these standards is mandatory for reliable operation and continued compliance with these standards is the basis for warranted performance.

Specific requirements are provided for the computer and subsystems. These requirements are derived from several sources including manufacturers technical documentation, standard commercial practices, national and local building codes and regulation and most importantly, our experience in designing, constructing and operating simulator facilities.

Additional information is included below as recommended guide-lines for the system. This information is based on experience gained from major simulator installations.

3.2 Storage Requirements

The simulator equipment may be stored by the customer for a period up to 4 months.

The following requirements has to be followed:

Temperature	:	0°C to +50°C
Maximum Temperature Gradient	:	15°C per hour
Relatively Humidity	:	5% to 90% no condensation

The equipment must be kept in its original packing - unopened. The crates must not be stored on top of each other. Storage must take place indoors.

3.3 Environmental Requirements

Local climate conditions and the system configuration are essential to the requirements for heating, ventilation and air-conditioning. The heating ventilation and air - conditioning system must provide a sufficient air flow with correct temperature and humidity.

- Ideal temperature : 23°C± 3°C
- Ideal relative humidity : 50% ± 10%
- Dust : The air pressure in the simulator rooms should be higher than the pressure outside. Special demands are made on the air-conditioning units filter if the air includes corrosive gases, salts, conductive particles or other unusual particles of dust.

Minimum and maximum requirements when in operation:

- Minimum temperature : 10°C
- Maximum temperature : 30°C
- Relative humidity : 10% to 95% no condensation

If the humidity is lower than 40%, there may be problems with static electricity.

To ensure a reliable operation of the air-conditioning unit, preventive maintenance should be carried out regularly.

A thermo-stat must be installed in the different rooms so the temperatures can be set individually.

NOTE ! The Air - Conditioning equipment must include an automatic restart after a power failure.

There is a requirement to maintain air-conditioning even if equipment is shut down, because parts of the system remain energized. If the humidity specifications are not maintained, condensation can accumulate causing damage to circuits when power is reapplied.

3.4 Main Power Requirements

Provisions are made for routing cables. Cable trays provides protection for the cables, shielding from electromagnetic interference and retaining access to the cables for maintenance.

The modular nature of the simulator components dictates a large number of available power outlets. If possible, major components should be isolated from each other. For example, a fault in one room should not cause the loss of power in all rooms. Similarly, a failure in one room should not cause a power transient that would damage other parts of the computer system.

Power conditioning is also important, especially if the local power sources do not provide the constant voltage and frequency required for system operation. Voltage spikes may be undetected and do no visible harm, when in fact the damage caused may be considerable and will only come to light as a serious failure later on. Then the cause may be difficult or impossible to determine.

To avoid serious system failures an uninterrupted power supply (UPS)should be installed

The Main supply to the electronic equipment should be taken from the buildings main supply.

The main supply cable should be protected from lightning by varistors.

All circuits should be protected by slow blow automatic circuit breakers.

Voltage

- 230 V AC± 15 V AC RMS Single phase

Frequency

- 50 Hz ± 0,5 Hz

Permitted Voltage Fluctuation

- For duration of 5ms : +20% or -10% of normal phase voltage
- For duration of 30m : +15% of normal phase voltage

Permitted Amplitude Distortion

The momentary voltage may not differ more than 6% from a sinusiod voltage of the same RMS voltage

Start Current

- Up to 5 times normal current dependent on the configuration.
- The start current may vary from 10 ms to 10 seconds dependent on the configuration.

Power Consumption

- Up to 3,5 kVA is required to run a full scale simulator.

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Chapter 4

Functional Description

4. FUNCTIONAL DESCRIPTION

4.1 Introduction

The modelling of this Cargo Handling Trainer CHT2000-VLCC-II-ws is based on the following Vesselís particulars:

M.T. "Polar Lady"

Loa	305.00 m
Lpp	295.00 m
Breadt moulded	47.00 m
Depth moulded	30.40 m
Summer draught	19.07 m
CB	0.801
Displacement,summer draught	217,552 tonnes
DW, summer draught	187,997 tonnes

Cargo tanks:

	Net. volume(CBM)	LCG(m)	VCG(m)
CT. # 1	30,813	235.23	12.69
CT. # 2	30,818	182.46	12.68
CT. # 3	30,818	129.72	12.68
CT. # 4	30,806	76.98	12.68
WT. # 1 P+S	25,106	232.90	13.22
WT. # 2 P+S	18,564	191.93	12.64
WT. # 4 P+S	29,024	129.73	12.64
WT. # 5 P+S	17,604	86.85	13.12
SL.TK P+S	8,048	60.53	14.64

Segregated Ballast Tanks:

	Net. volume(CBM)	LCG(m)	VCG(m)
FP	12,113	276.19	13.99
WT. # 3B P+S	10,460	165.62	12.63

HFO. Tanks:

	Net. volume(CBM)	LCG(m)	VCG(m)
HFO. FWD	3,800	263.86	13.41
HFO. TK. AFT	3,800	48.51	13.96

Cargo Pumps:

No. of set	4 Centrifugal Type Cargo Pumps
Capacity	4,000 cbm/h 120 mLC

Oil/Gas Separators:

No. of set	4 Gas/Oil Separators

Stripping Pumps:

No. of set	1 Reciprocating Stripping Pump
Capacity	350 cbm/h

Stripping Eductor:

No of set	1 Stripping Eductor
Capacity	1500 cbm/h

Ballast Pump:

No, of set	1 Centrifugal Type Ballast Pump
Capacity	4,000 cbm/h 120 mLC

Cargo Lines:

No. of set	4 segregated cargo lines
Size	

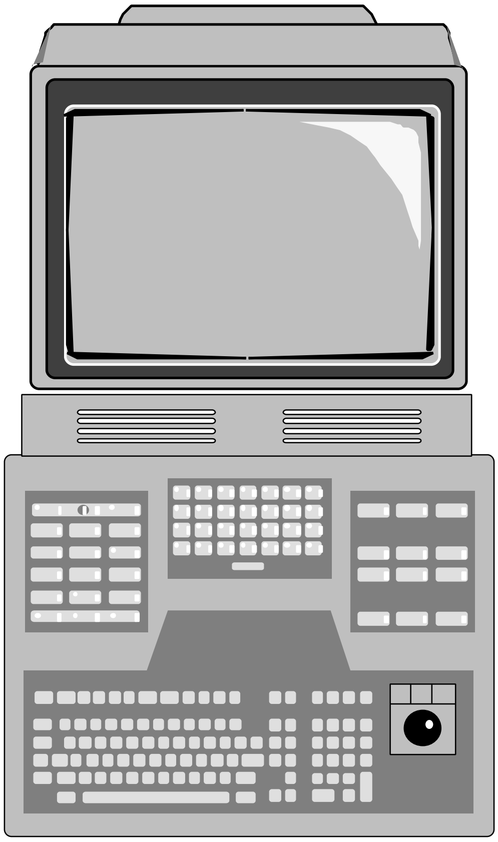
Ballast Line:

No of set	1 segregated ballast line
Size	

P/V Valves:

No. of set	One for each tank
Range	- 0.45 - 0.45 mWC

4.2 Computer System



The graphic workstations are in principle used for running general UNIX applications. However, UNIX is concealed in the simulator as soon as the operator has logged in. The work stations will thereafter be operated in a graphic man-machine-interface in a "point and click" fashion by using a dedicated operational keyboard and a roller ball.

On the operator stations, the operator/student(s) can view mimic pages representing the various simulated systems. These graphic mimic process diagrams are interactive, i.e. the process can be both monitored and controlled.

In principle, all the graphic workstations can be configured as instructor stations. Whenever a workstation is going to be used in part task mode, the student using it will act as his own instructor, meaning that he will have the instructorís privilege to start/pause the simulation. Each individual can run the exercise at his own pace.

The pushbuttons on the operational keyboard are grouped together in logically arranged clusters. All the instructor functions are located on the left side of the keyboard. The keyboards have a key, with which the instructor can prohibit student(s) access to the instructor functions on the keyboard.

The following pages comprises a functional description of the main cargo handling systems and related sub-systems. The process diagrams with corresponding information such as temperature, flow, pressure, set points, etc. are presented on the colour graphic workstation. Additional diagrams and information giving insight to the simulated models are available and can be addressed by using the functional keyboard.

The Process Diagrams presented have the following colour code for pipelines:

- Light Blue: Steam
- Blue: Fresh Water
- Green: Sea Water
- Yellow: Diesel Oil
- Brown: Fuel Oil
- Orange: Cargo
- Pink: Vapour

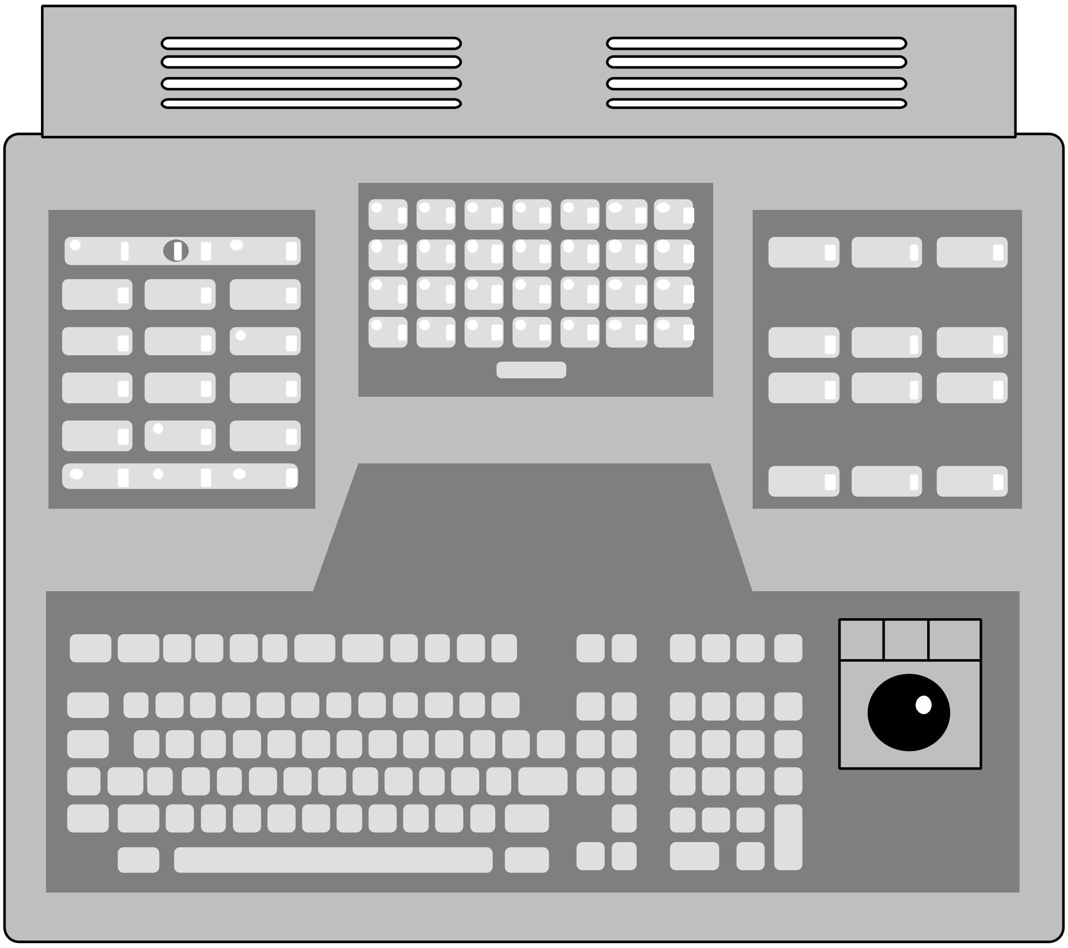
The Cargo lines have the following colour code:

- Green: Line no. 1
- Yellow: Line no. 2
- Brown: Line no. 3
- Red: Line no. 4

The Process Diagrams comprises abbreviations such as, T, G, P etc. meaning:

T: Temperature
G: Flow
P: Pressure
N: Rpm
Q: Force
I: Ampere
U: Voltage
F: Frequency
E: Electrical Power
V: Valve
L: Level
X: Position
Z: Signal/Concentration
W: Viscosity
c: Constant
d: Density
H: Heat Transfer
M: Mass
R: Pump, Fan Status

4.2.1 TEC2000 Instructor System



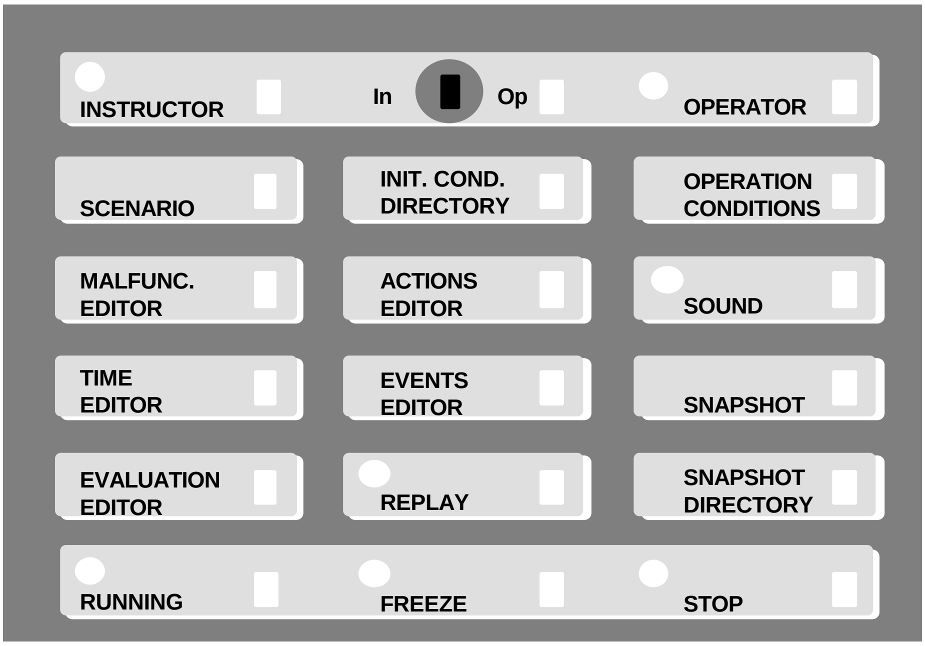
The instructor system is equipped with a TEC2000 keyboard. The keyboard includes a normal QWERTY keyboard, Instructor section, Alarm section and Operator section . For detailed information see TEC2000 Instructor Manual.

Trackerball:

On the TEC2000 is a trackerball with 3 buttons on top.Trackerball moves cursor on the screen. Function of left button is: START pump/compressor or OPEN valve. Centre button to operate screen BUTTONS or to open display windows. Right button is opposite of left, namely STOP pump/compressor or CLOSE valve.

Function buttons:

INSTRUCTOR KEY OPERATOR Chooses between operator / instructor status. One push on the desired button will change status. When key is LOCKED, changing of operator status is not possible. Key locks when turned CLOCKWISE.



Scenario:

Displays different scenarios to be used during simulation classes.

Active in instructor mode only.

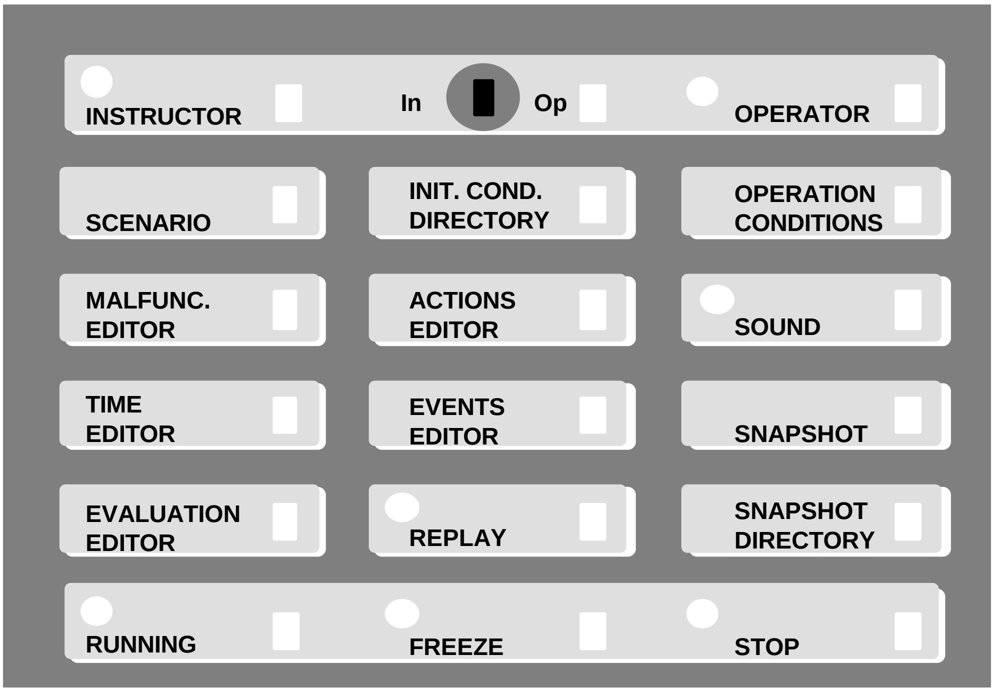
Instructor:

To create a scenario, enter scenario by pressing SCENARIO button. Prompts on screen will guide you onwards. Push software button CREATE, and click on a scenario button where you want it placed. (S01 to S20)

After prompt and typing of scenario name, press enter. When entered name "attaches" to button, scenario is accepted. A prompt will then ask for an INITIAL condition to obtain parameters from. Type in initial condition I01 to I60, and press enter.

If accepted, prompt line will add initial conditions name and change colour.

When using instructors key pad (left side group of buttons), all the other available pages in editor are visible in top right corner of picture. Clicking on any of these software buttons will bring you to this picture, as would pressing any of same hardware buttons.



Init Conditions Directory:

Displays recorded initial conditions. Active in instructor mode only.

Instructor:

To create an initial condition, "play" until desired running status is obtained. This is done in the same fashion as running an actual plant. Opening valves and starting pumps until a stable running condition on different levels is achieved.

When satisfied with simulator situation, chose display INITIAL CONDITION and click on CREATE. Type in name of condition and press enter.

When various levels of complexity have been recorded, these initial conditions can be run under scenario to create realistic simulations of actual on board situations with the assistance of malfunction editor and scenarios.

To load an initial condition, click with centre trackerball button on chosen condition. Loading of initial condition in FREEZE mode only.

Operating Conditions:

Sets the response to actions during simulation.
Active in instructor mode only.
Instructor:
Picture is divided into 9 windows where parameter responses can be set.

- Access

Different access levels can be set. Ordinarily only instructor can access OPERATION CONDITIONS to establish simulation parameters.

- Fixed process

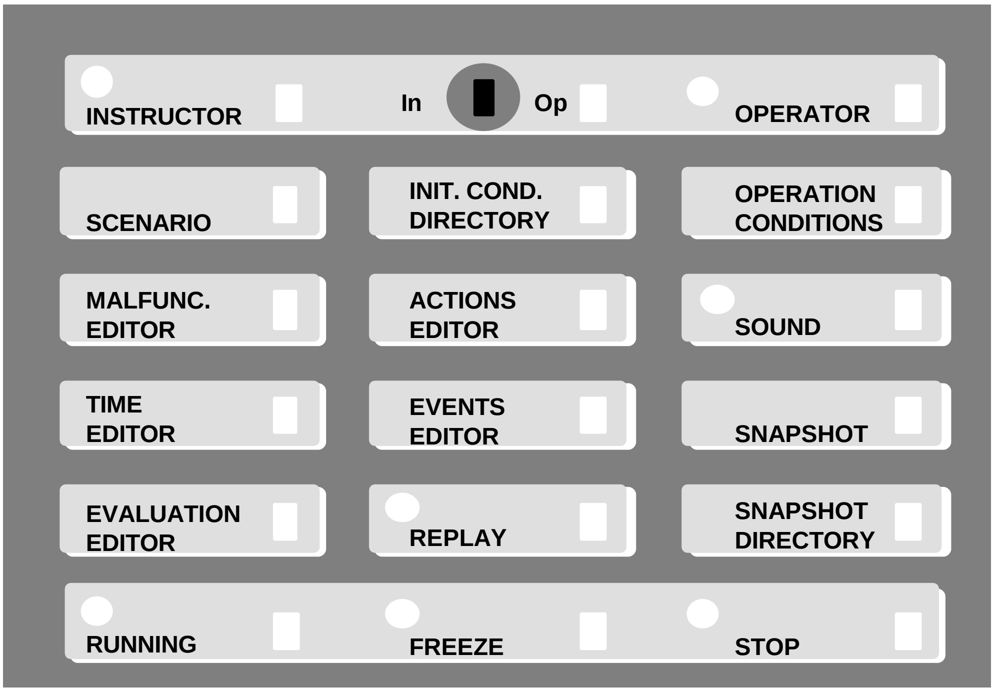
Instructor can set some systems in permanent no alarms condition. Useful when sub systems are to be simulated without disturbances.

- Inhibit keyboard buzzer

Toggles buzzer sound active / inactive.

- Levels

Sets simulator response time constant for tank levels. Choose between three levels, slow to very fast.



- Dynamic response

  Sets simulator time response constant for controllers.

- Ship dynamics

  Will change ship dynamic response time constant.

- Log printer 1

  Determines which events or alarms to be logged on printer. All five buttons can be activated simultaneously.

Snapshot column:

Whenever simulator creates a simulation snapshot, this will be placed here for later retrieval. Snapshots enter under a button with inserted time when snapshot was made. Snapshots can be auto generated with push button snapshot intervals. When pushed, page will prompt for intervals between snapshots.

Note: Snapshot will only be visible when the simulation is started from the same initial conditions.

Malfunction Editor:

Allows editing of malfunctions during simulation.

Only possible from INSTRUCTOR MODE.

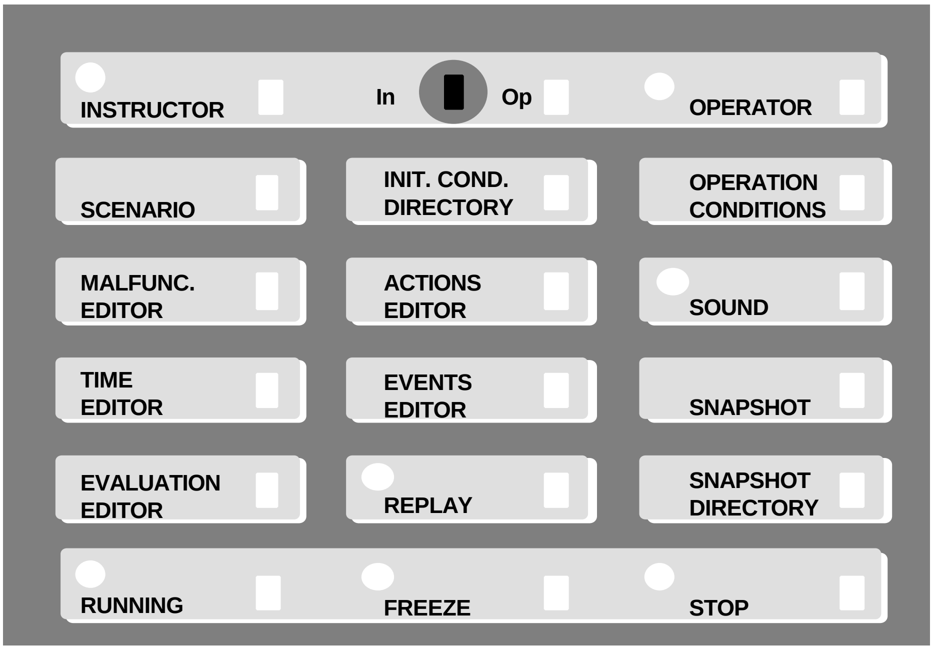
Instructor:

A scenario with an initial condition must be available and chosen. This will be indicated on pictures right side. To create, click on software button CREATE and click on one of the buttons M01 to M40 and type in chosen name.

IMPORTANT: When a malfunction name has been typed and ENTERED, a prompt will ask you which TAG name is wanted.

THIS TAG NAME MUST BE WRITTEN WITH FULL STYLE NAME AND NUMBER DIRECTLY COPIED FROM MALFUNCTION LIST. IN ADDITION TYPE IN EITHER _S OR .S. OTHERWISE TAG WILL NOT ENTER. WHEN PROMPT CHANGES COLOUR, IT WILL BE WRITTEN F.EX. M0201_S , AND YOU ARE ALLOWED TO CONTINUE.

In section VALUE, active and passive values are entered. When prompted, type in values either digital (0,1,2 etc.) or analog in percentage of max values.

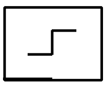


ACTIVE Value entered is value when fault is activated. Either one triggered as one continuos fault or as repeating fault.

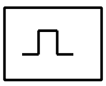
PASSIVE Value entered is starting level. That is condition of operation before fault is activated.

UNIT Engineering unit or percentage. Not necessary to be entered.

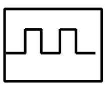
AUTOMATIC MODE:



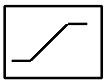
Activating this will make fault go active, and stay active, when entered time is reached.



Activating this button will make fault go active, and then off again when time limits entered are reached.



Activated, this button will make fault go on and off repeatedly within specified time limits, as long as scenario is run.

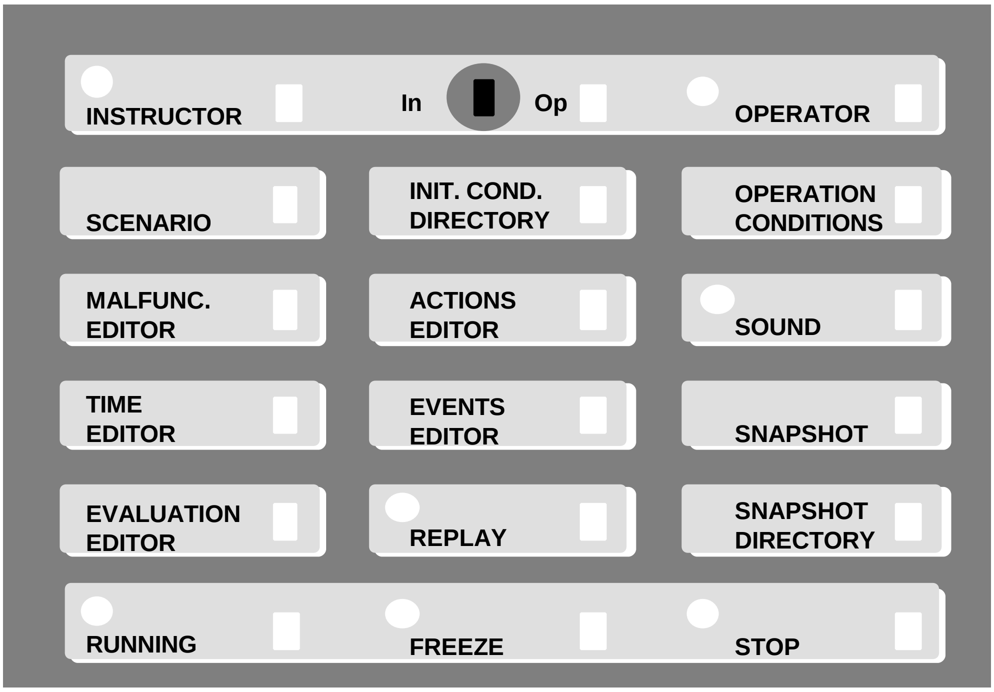


When activated, time ramp for fault to develop can be specified.

Common for all four function buttons are that faults can be simulated after entering a scenario only when buttons are activated. When active, buttons change colour. Ramp function can be active together with any of three other buttons.

To activate click on buttons with centre trackerball button.

On the bottom half of screen (buttons A41 to A80) is event malfunctions. Used and created as malfunction, but triggering actions instead of malfunctions. Such as closing of valves.



Action Editor:

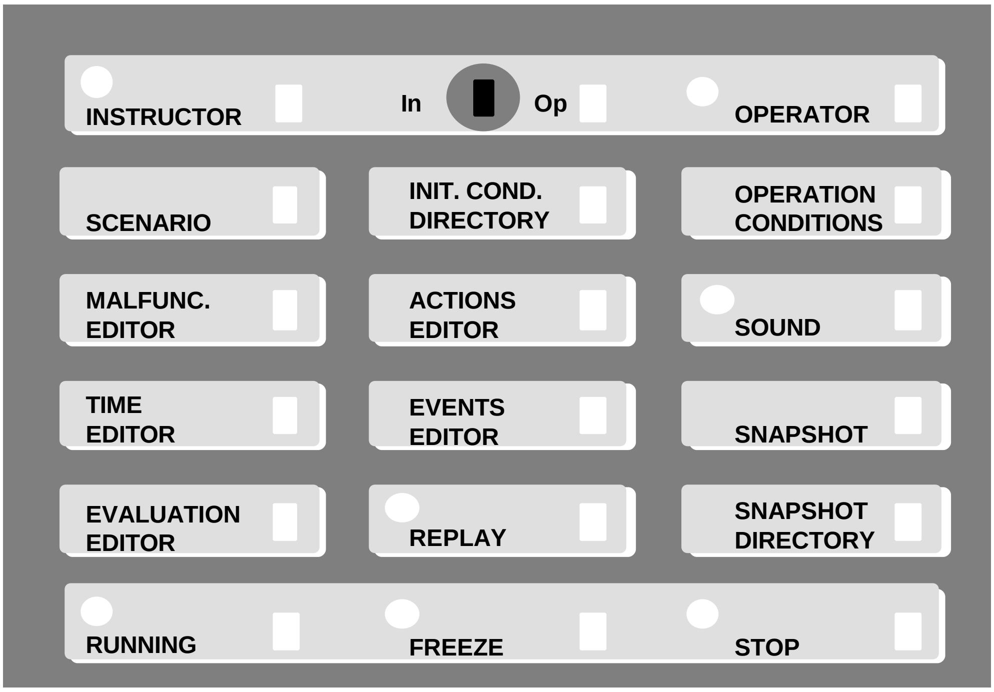
Allows editing of actions, i.e. somebody stopping a pump unintentionally..
Active in instructor mode only.

Using and creating actions as malfunction editor. Input of tag names similar to malfunctions editor, adding period S or underscore S after tag. When starting a scenario, wanted malfunctions and action to be performed during simulation must be chosen by clicking on software buttons. Changing colours will indicate which buttons are activated. In front of each buttons is a light with 2 circles. Inner circle lit means that READING is active, meaning set intervals are reached, and action started.

Outer circle lit means action is activated, but waiting for set time interval to be reached in order to switch action on.

Time Editor:

Allows editing of response time.
Active only in instructor mode.



Instructor:

Clicking on CHANGE TIMEPHASE software button enters a line on time section of picture. Using inner scroll buttons to locate change line between actions or events to be changed. Then outer scroll buttons to change time phase.

Event Editor:

Active in instructor mode only.

Allows editing of events, meaning specific actions or malfunctions to be initiated in proper sequence.

Snapshot:

Takes a snapshot of simulation for later reference. Places snapshot in snapshot directory with time/date reference.

Active only in instructor mode.

Evaluations Editor:

For evaluations of student response during simulation. Active in instructor mode only.

Input of specified measuring variables under tag name. Specify upper and lower limits. Will evaluate how process is kept by student during simulation. Evaluation criteria is whether student is able to maintain process within specified limits.

Running:

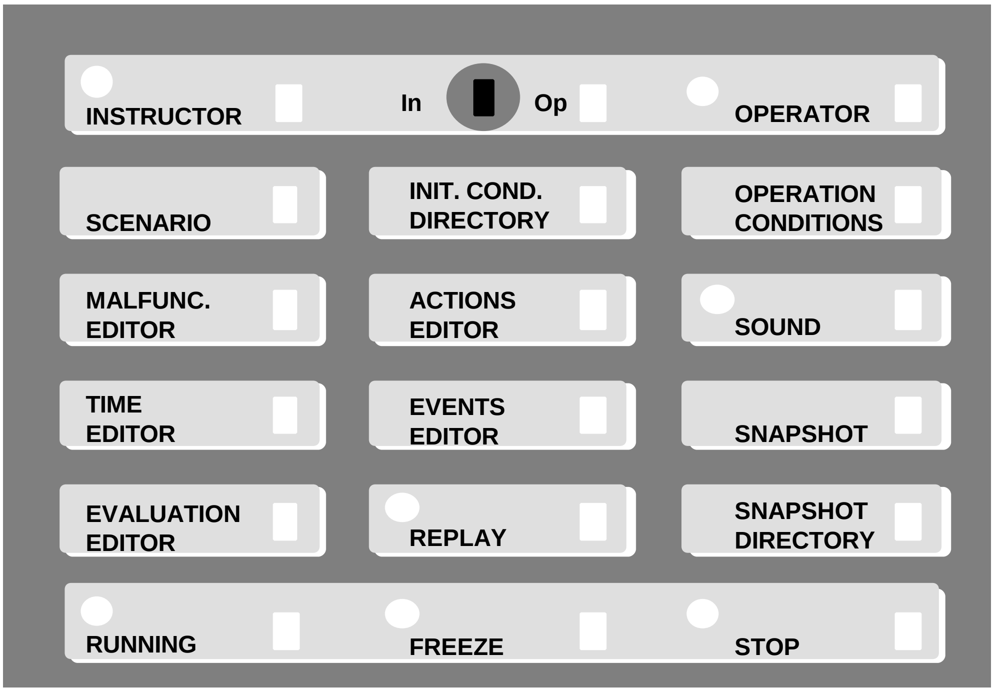
Starts simulation after init. conditions or freeze.
Active only in instructor mode.

When RUNNING button is pushed, a prompt will inform that simulation is started.

Freeze:

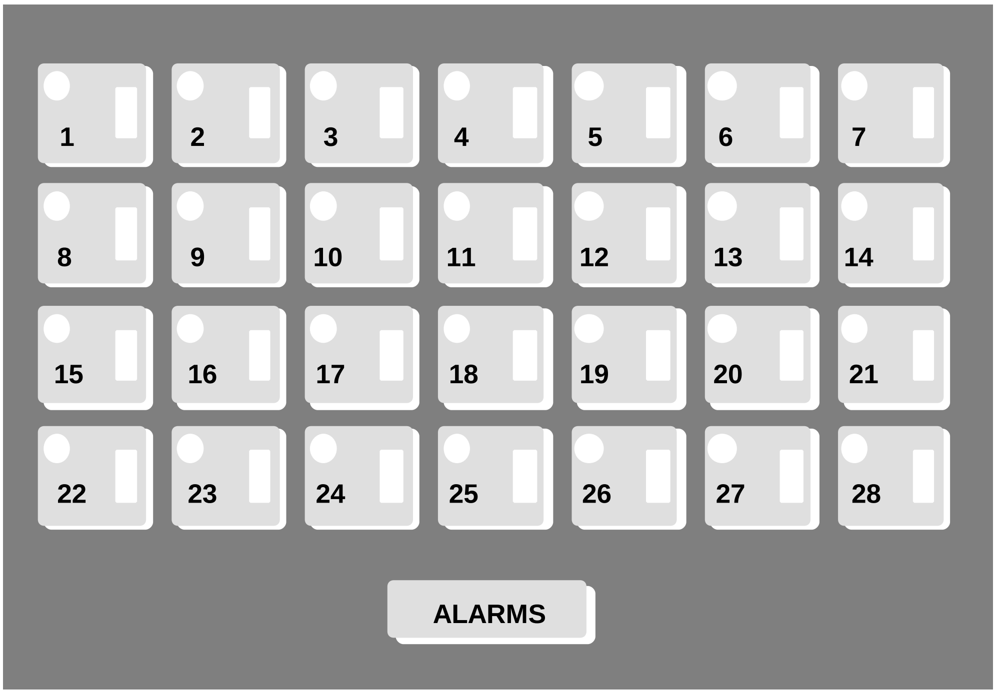
Freezes simulation during breaks or when situation needs time-out for evaluation. Active only in instructor mode.

When FREEZE button is pushed, a prompt will inform that simulation is halted.



Stop:

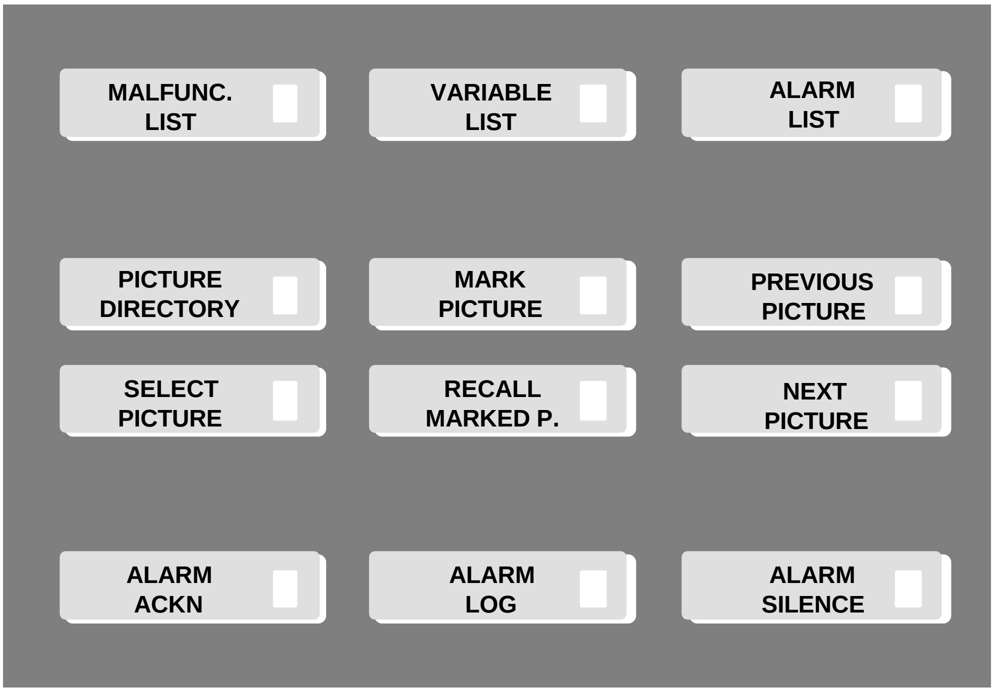
Ends simulation after a prompt. Pressing STOP and typing yes after prompt will log out of simulator completely. Active in both modes. To restart: Type LOGIN and press ENTER. Type sim in both login name and password. Remember to press ENTER after each input. Select one of offered options. Load initial condition by pressing selected condition button. Initial condition found in INITIAL CONDITIONS DIRECTORY.



Alarm Pages:

Pushing one of the buttons marked 1 to 28 will display a window on screen with system tag information.

List is divided into several columns.



Malfunction List:

Displays window with possible malfunctions directory page. When main system is recognised, a click on system button displays system list. List can be scrolled or removed with cursor and centre trackerball button. Active in both modes.

Operator:

Push button MALFUNCTION LIST, and select subsystem by clicking on this. Clicking on system will activate second window with system variables.

After location of suspected fault, click on this lines COLON with RIGHT tracker ball button.
A prompt will identify tag, and that a repair attempt is made.

Instructor:

As in operator mode, but additional information displayed.

Clicking on selected lines COLON with LEFT trackerball button will toggle faults ON / OFF.
When a fault is selected ON, it will change colour, and thus be identifiable.

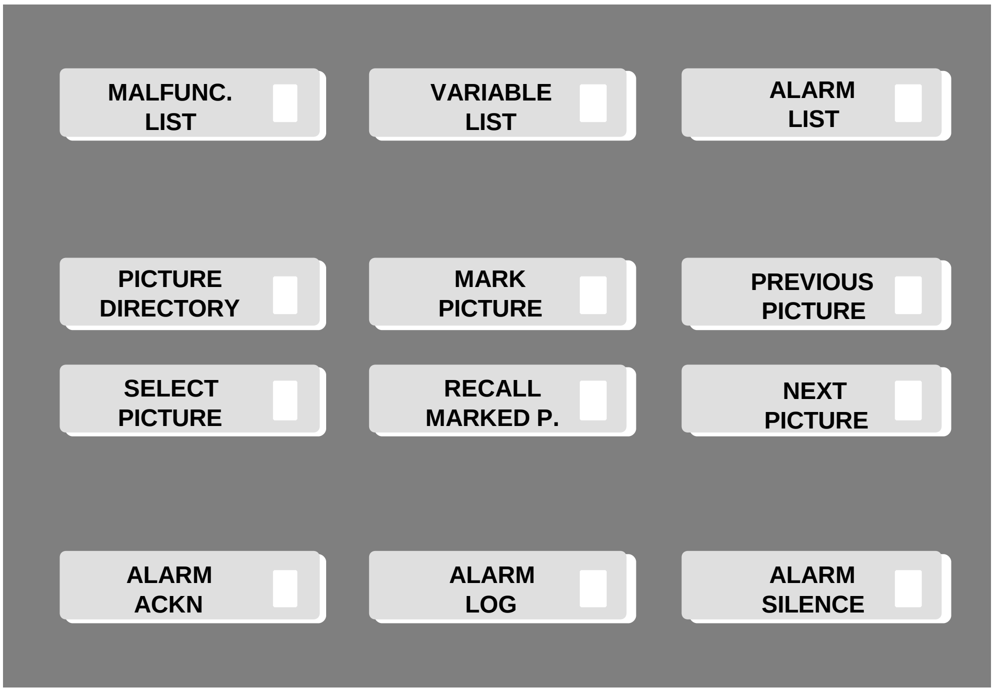
Far right of each line is a numeric value in percentage. Clicking on this with centre trackerball button will allow entering rate of wear for component. Selecting 100% rate of wear will render component useless instantaneously. When a fault is selected ON, the system picture will have the M button in lower left corner lighted in yellow. Student , in operator mode, will not have this indication of active faults.

Variable List:

Displays window with list of variables directory. After recognising main system, clicking on system button displays list of variables for this system. List can be scrolled, moved or removed with centre button on trackerball and cursor.

Instructor:

After pushing VARIABLE LIST, identify sub system and press selected system. Displayed window will then be identical to that mentioned in alarm pages. Tag details and measured values will be displayed. Displayed data can be changed after clicking on values with centre trackerball button. After typing in new values, and pressing enter, new data entered will gradually return to measured values. Selecting upper / lower alarm limits, and entering new data will permanently reset limits.



Operator:

Read only, no actions or changes possible.

Alarm List:

Displays window with alarm page directory. After recognition of system, clicking on system displays list of alarms in this system.

List can be scrolled, moved or removed with cursor and centre trackerball button.

Instructor:

After pressing on ALARM LIST and identifying sub system, window with list of alarms will be displayed.

Picture Directory:

Displays list of system pictures. After recognition of system, and clicking on this, system picture will display on screen.

Mark Picture:

Clicking on this will mark picture for later recollection with RECALL MARKED PICTURE. After clicking MARK PICTURE, enter a chosen number. After clicking RECALL MARKED PICTURE, enter chosen number.

Select Picture:

Allows selection of picture after writing picture name in prompt. Enter two letters and two digits without space.

Previous Picture:/Next Picture:

Allows scrolling to next/previous picture in line as listed in picture directory.

Alarm Acknowledge:

Acknowledges external lights.

Alarm Log:

Displays active alarms. To acknowledge all alarms displayed at once, press EXTENDED CHAR button and A simultaneously.

Alarm Silence:

Shuts off alarm sound.

4.2.2 Fault System

A comprehensive selection of malfunctions are available through the fault system. Each sub-system is provided with a large number of malfunctions. These are selectable from the Instructor Station during full simulation mode, and from each workstation when in part task mode.

The pages in chapter 7 show the choice of malfunctions which can be introduced. The two first pages comprises the Directory List, while the rest of the pages contain the malfunctions available.

4.3 Hull Models

The content of liquid in the tanks will have an inevitable impact on the hull condition in terms of:

- Hydrostatic conditions
  - Draft
  - Heel
  - Trim
- Intact stability: Meta-centre height
- Hull Strain:
  - Shear force
  - Bending moment
  - Hull deflection

These parameters are continuously computed based on currently updated tank levels and liquid densities. In addition, manually entered data will be computed and updated.

Basic hull design

Based on outline specification on main geometrical data the following items have been computed:

- Hydrostatics
- Loading conditions:

  Light ship condition with:

  Intact stability

  Shear force distribution

  Bending moment distribution

- Ballast condition with:

  Intact stability

  Shear force distribution

  Bending moment distribution

- Full load condition with:

  Intact stability

  Shear force distribution

  Bending moment distribution

- Longitudinal strength including limit values for:

  Shear forces

  Bending moments

  Moment of inertia

  Bonjean tables

Hydrostatics

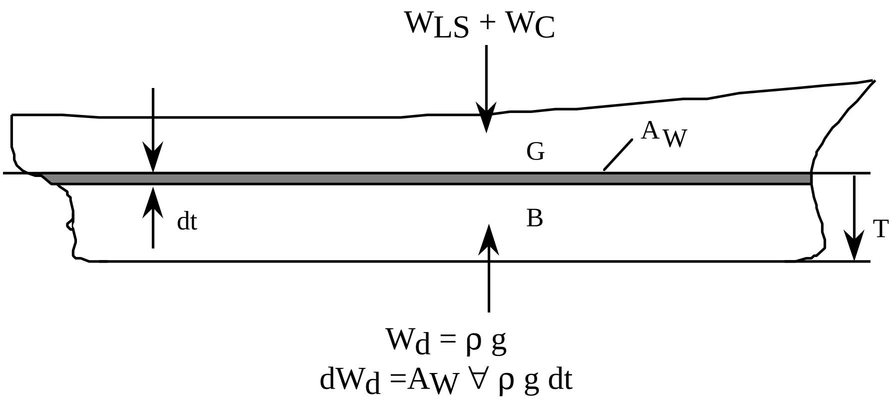
The current computation of hull hydrostatics at the actual load conditions is made by the hull simulation models. The following parameters are computed:

- Draught
- Trim
- Heel

Draught

The draught is adjusted until the weight of the displaced water equalise the light ship weight plus the cargo weight.

$W_d = W_{LS} + W_C$

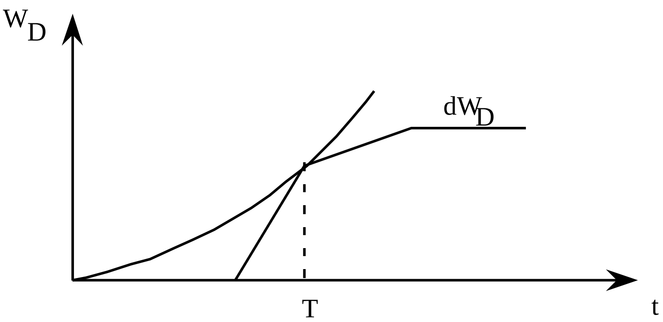


Change in draught due to change in cargo

When the weight of the cargo is changed the draught will be changed accordingly. The change in draught can be estimated from the formula for displacement (Tons) Per. Cm draught:

$$\delta W_D = \rho A_W * 0.01 (Tons/Cm)$$

This can be found in the tables and curve sheet for the hydrostatics.



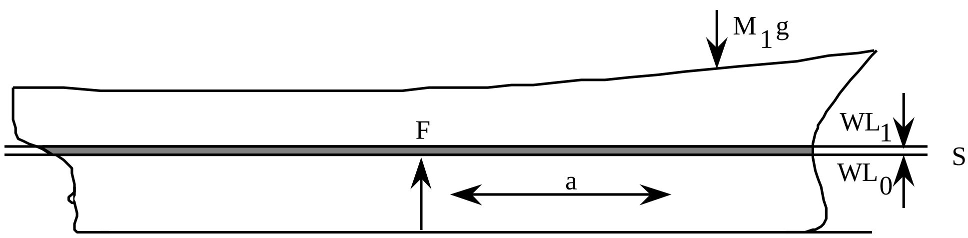
Trim

Trim is adjusted until the trimming moment is equalised by the buoyancy moment from the displaced water.

The trimming moment is calculated for the Longitudinal Centre of Flotation (LCF), and the trimming is made at this point.

The location of the LCF is given by the shape and area of the hull's water-plane at the actual draught, as the total longitudinal moment of water-plane area is to be equal to zero at the LCF.

$$\int_0^L x \, dA_W = 0$$

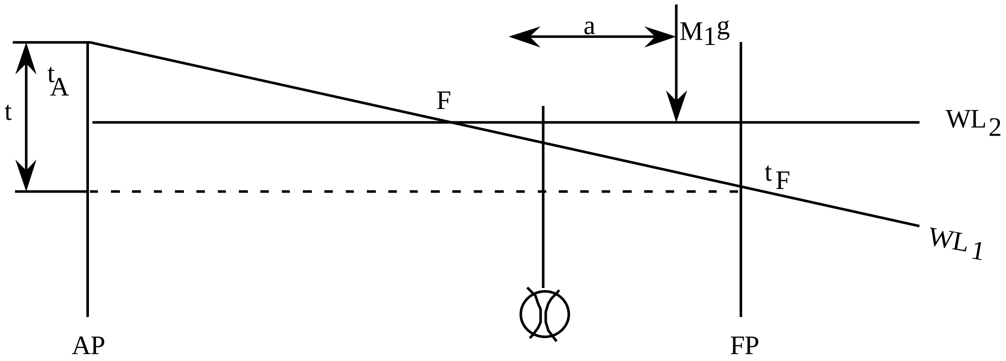


Change in the trim

The amount of trimming can be estimated by means of the Moment To Trim 1 Cm (MTC). formula:

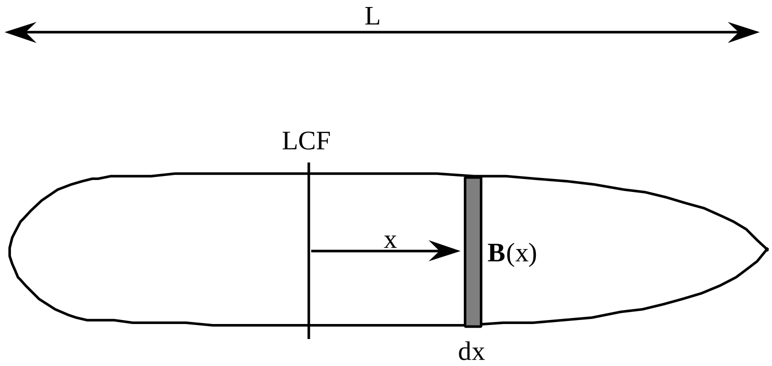
$$\delta \text{ MT} = \frac{\rho I_L}{L}$$

This can be found in the hydrostatics tables.



Heel

The heel is adjusted until the heeling moment is equalised by the buoyancy moment of the displaced water. The heeling will always take place along the longitudinal centre line.



Water - plane area

$$A_W = \int_0^L dA_W = \int_0^L B(x)\,dx$$

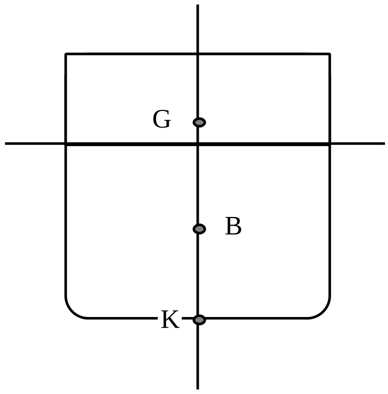
Water - plane moment of area (longitudinal)

$$F_L = \int_0^L x\,dA_W = \int_0^L B(x)x\,dx$$

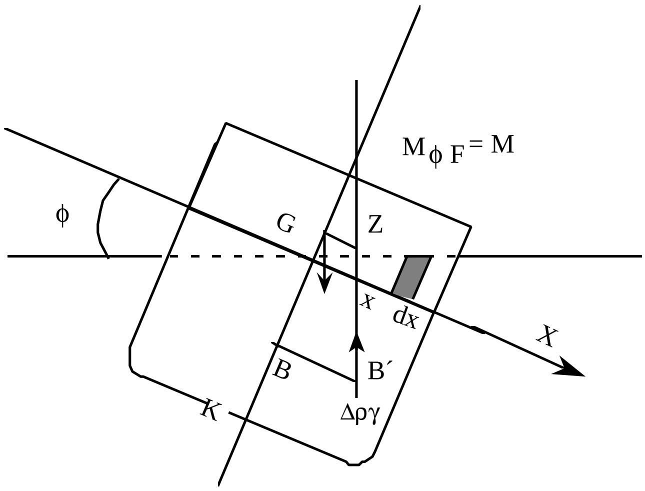
Water moment of inertia (longitudinal)

$$I_L = \int_0^L x^2 dA_W = \int_0^L B(x)x^2\,dx$$

Intact Stability



As long as the vessel lies in upright position there will always be an equilibrium between the weight forces (light ship + cargo) acting through the gravity centre, G, and the total buoyancy forces acting through the buoyancy centre, B, G and B will always be located on the same vertical line at a distance of KG and KB from the keel respectively.



When the ship is inclined due to a heeling moment, the buoyancy centre will move to a new position, B, due to the change in the displacement's volume and shape.

The vertical line through b will cut the ship centre-line at an angle, 0, in the point M. At small angles of heeling point M is called the Initial Meta Centre.

The horizontal distance between the centre and gravity, G, and the vertical line through the new centre of buoyancy, B, is denoted GZ and represents the arm of the rectifying moment.

At small angle of heeling (which normally will be the case) GZ = GM $\sin\theta$ The total rectifying moment counteracting the heeling will then be:

$$M = \rho\, gV_D * GM \sin\theta$$

Thus:

When GM > 0 -> M > 0
I.e: The heel will be counteracted and the ship is said to be stabilised.

When GM = 0 -> M = 0
I.e: The heel will remain and the ship is said to be indifference.

When GM < 0 -> M < 0
I.e: The heel will increase and the skip will be unstable.

The considerations above are based on the height, GM, which is called the Meta Centre Height.

$$GM = KB - KG \text{ (ref. fig Ship Heeling)}$$

$$GM = KB + BM - KG$$

$$GM = KB + I/V_D - KG$$

Where:

I	=	The waterplane´s longitudinal moment of inertia at the actual draught.
V_D	=	The volume displacement at the actual draught.

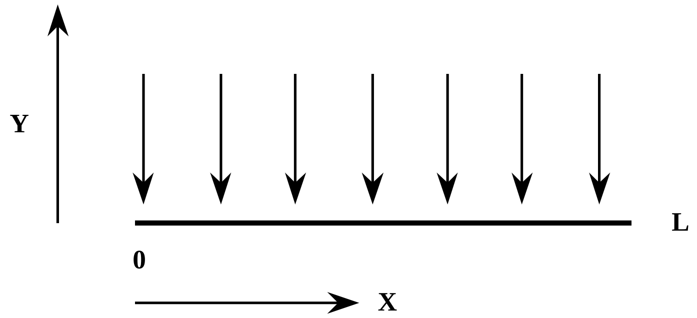
$$I = C_I LBT^3$$

Then:

$GM = KB + C_1 * B^3 / C_B * T - KG$

Load distribution

The relationship between the load distribution, the shear force, the bending moment and the deflection can preferably be illustrated by considering a straight beam with an even load, q0



The relationship between the load distribution, and the shear force, the bending moment and the deflection can then be expressed as follows:

The load distribution:

(1) $q0 = EI\, d^4y / dx^4$

The shear force:

(2) $-Q = EI\, d^3y / dx^3 = q0\, x + C_1$

The bending moment:

(3) $-M = EI\, d^2y / dx^2 = q0x^2 / 2 + C_1x + C_2$

The inclination:

(4) $EI\, dy / dx = q0\, x^3 / 6 + C1\, x^2 / 2 + C_2x + C3$

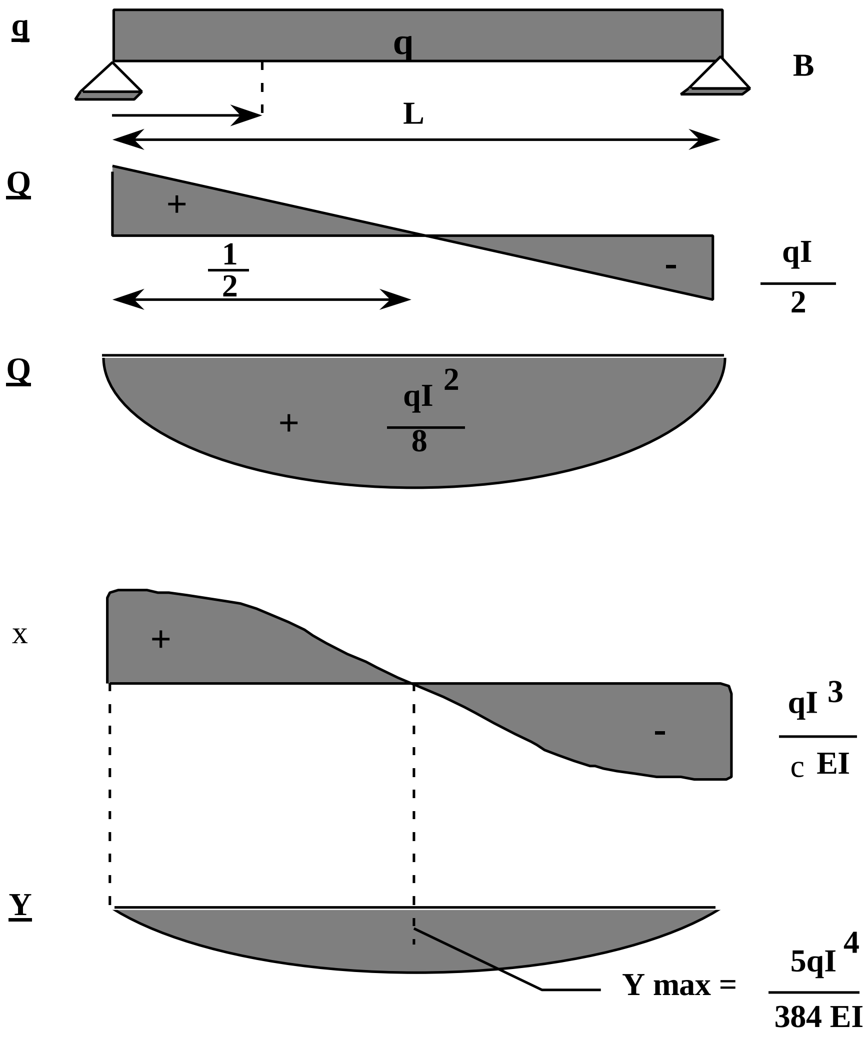
The deflection:

(5) $EI\ y = q0\ x^4 / 24 + C_1\ x^3 / 6 + C_2\ x^2 / 2 + C_3 + C_4$
Where:

The integration constants will be dependent on the actual support of the beam and has to be decided in each particular case.

Example:

A beam with even load and free supports in both of the ends will have the following relationship between load distribution, shear force, bending moment, including and deflection.



The Ship's Hull

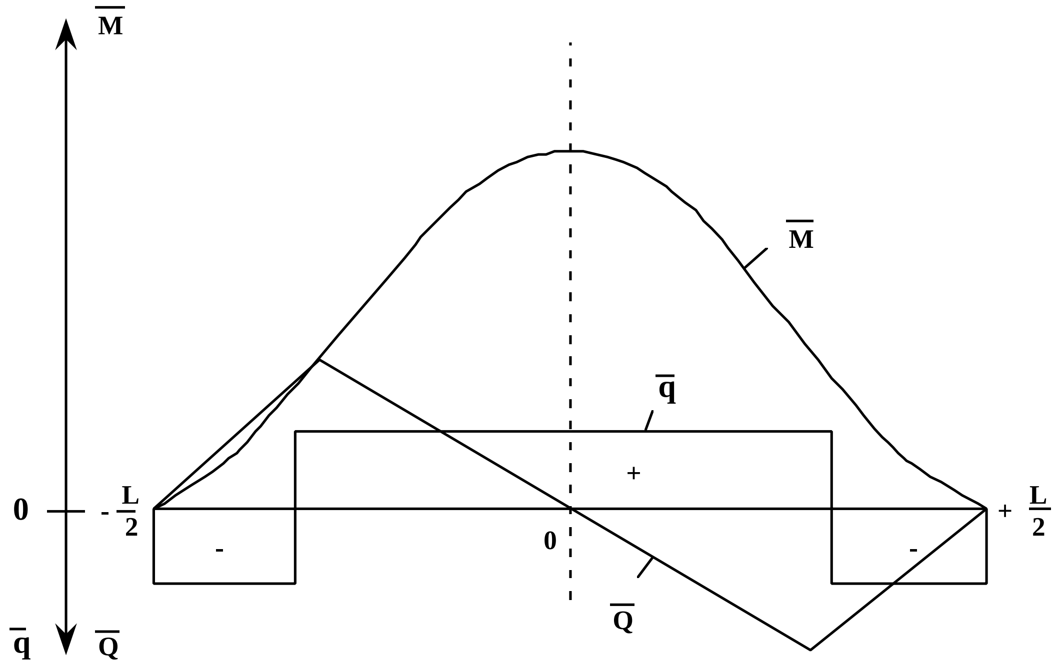
The ship's hull will differ from an even loaded beam in two ways:

- The load distribution will not be even throughout the hull.
- The cross section area and the corresponding moment of inertia will vary along the hull.

The load distribution along the hull will be:

q	=	$(q1_S + q_C) - qb$
q1s	=	Distributed weight, light ship.
qc	=	Distributed weight, cargo.
qb	=	Distributed buoyancy.

A simple example on the relationship between the load distribution, the shear force and bending moment is shown on the figure below.



It is evident that a more detailed calculation of load distribution, shear force, bending moment and deflection for a ship's hull is rather complex and will require a computer program.

The DataLoad programs included in the CHT2000 will continuously (i.e: approx. each 10th second) compute the parameters said on the current load condition related the ship's geometry and the hull's strength as stated in the computerised ship model of the Det norske Veritas, DnV.

4.4 Computerised Load Master

501	Cargo Bargraph (Load Master)				
502	Cargo Survey (Load Master)				
503	Shear Force (Load Master)				
504	Bending Moment (Load Master)				
505	Deflection (Load Master)				
506	Stability Curve (Load Master)				
		601	Misc. Tanks (Load Master)		
				100	Directory 1

The purpose of the Computerised Load Master is to avoid excessive bending stresses in the hull structure. These stresses vary with the cargo distribution throughout the length of the ship. Incorrect loading can damage the ship and hence the cargo/ballast must be placed according to a carefully calculated plan.

It is, however, impossible to foresee all possible cargo distributions. It is therefore necessary to have an easy-to-handle computer on board which can calculate all the appropriate stresses for every load distribution case.

In addition to the current data on draft, trim and heel, the Load Master also calculates the following, based on manual input:

- Hydrostatic conditions (draft, trim)

- Intact stability (FS; GM; GZ) Meta Centric height.

- Longitudinal strain (shear force; bending moment; hull deflection)

- Relative tank content

The output from the Load Master is displayed on the variable pages. The shear force, bending moment, hull deflection and stability curve can be screen dumped to the printer.

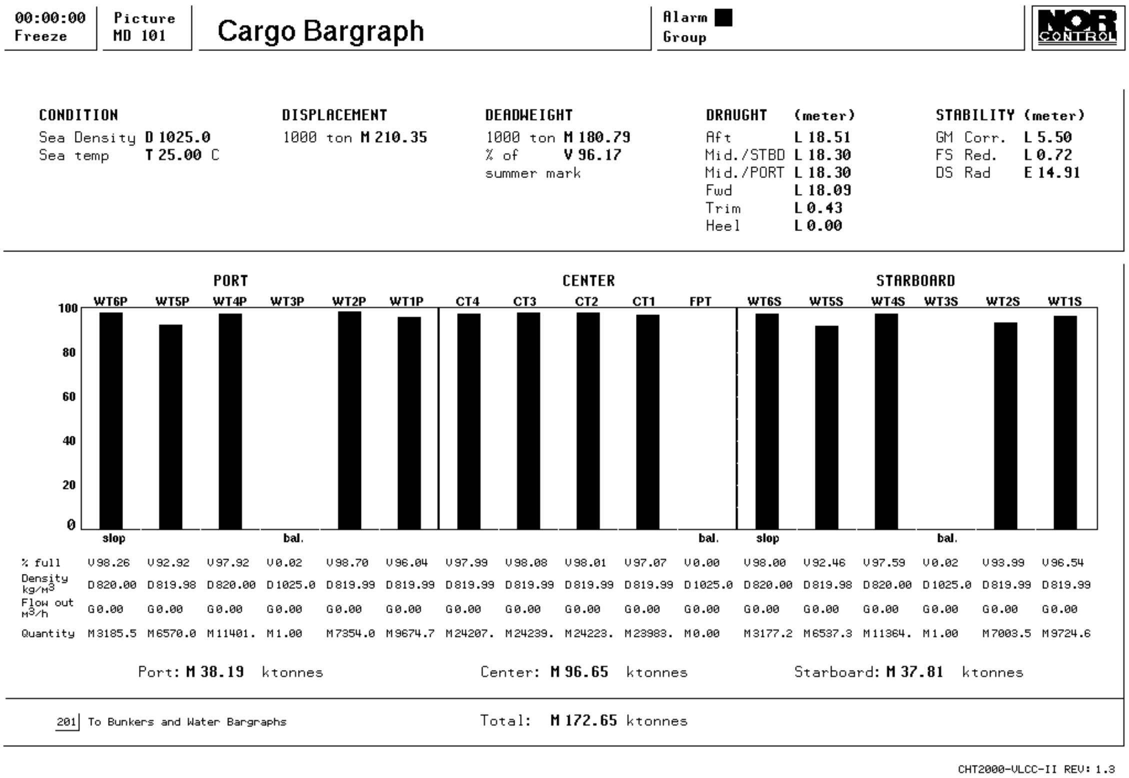
4.5 Model Description

101	Cargo Bargraph	128	Wing Tank 4 Port Condition	222	Center Tank 1 Atmosphere
102	Cargo Survey	129	Wing Tank 5 Port Condition	223	Center Tank 2 Atmosphere
103	Shear Force	130	Wing Tank 6 Port Condition	224	Center Tank 3 Atmosphere
104	Bending Moment	131	Wing Tank 1 Stb. Condition	225	Center Tank 4 Atmosphere
105	Deflection	132	Wing Tank 2 Stb. Condition	226	Wing Tank 1 Port Atmosphere
106	Stability Curve	133	Wing Tank 4 Stb. Condition	227	Wing Tank 2 Port Atmosphere
107	Load/Discharge	134	Wing Tank 5 Stb. Condition	228	Wing Tank 4 Port Atmosphere
108	Cargo Deck Line	135	Wing Tank 6 Stb. Condition	229	Wing Tank 5 Port Atmosphere
109	Cargo Pump Room	201	Bunkers and Water Bargraphs	230	Wing Tank 6 Port Atmosphere
110	Cargo Bottom Lines	206	Load Discharge Ballast Routing	231	Wing Tank 1 Stb. Atmosphere
111	Line 1	207	Monitor	232	Wing Tank 2 Stb. Atmosphere
112	Line 2	208	Boiler	233	Wing Tank 4 Stb. Atmosphere
113	Line 3	209	Inert Gas Plant	234	Wing Tank 5 Stb. Atmosphere
114	Line 4	210	Inert Gas Distribution	235	Wing Tank 6 Stb. Atmosphere
115	Ballast Line	211	Crude Oil Pump 1/separator		
116	Slop Tanks/Oil Discharge Monitor	212	Crude Oil Pump 2/separator	240	Cargo Pumping Diagram
122	Center Tank 1 Condition	213	Crude Oil Pump 3/separator		
123	Center Tank 2 Condition	214	Crude Oil Pump 4/separator		
124	Center Tank 3 Condition	215	Ballast Water Pump	300	Description of Legend
125	Center Tank 4 Condition	216	Stripping Pump/Eductor/Cow/Sw	301	Pen Recorder
126	Wing Tank 1 Port Condition				
127	Wing Tank 2 Port Condition			500	Directory 2 LOAD MASTER

The Directory will give the operator an overview of all process pictures. From this directory any picture can be selected including the Load Master directory.

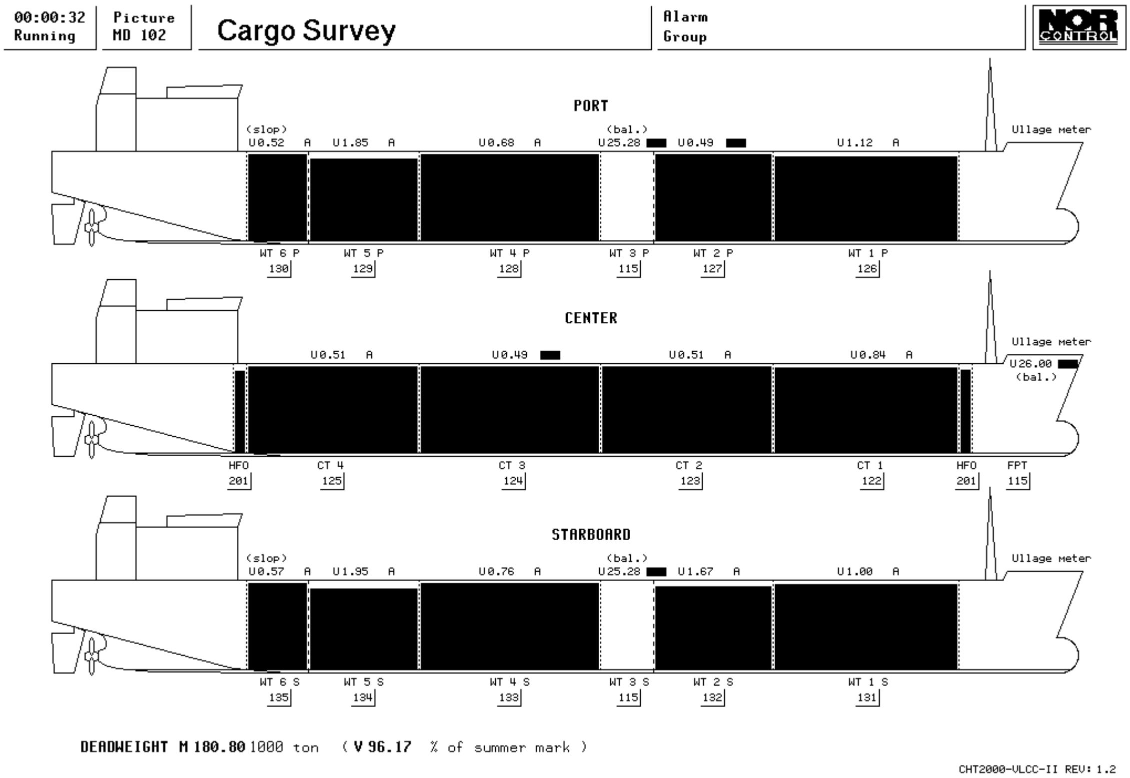
On the following pages you will find simplified drawings of the process pictures according to the directory.

4.5.1 Cargo Bargraph



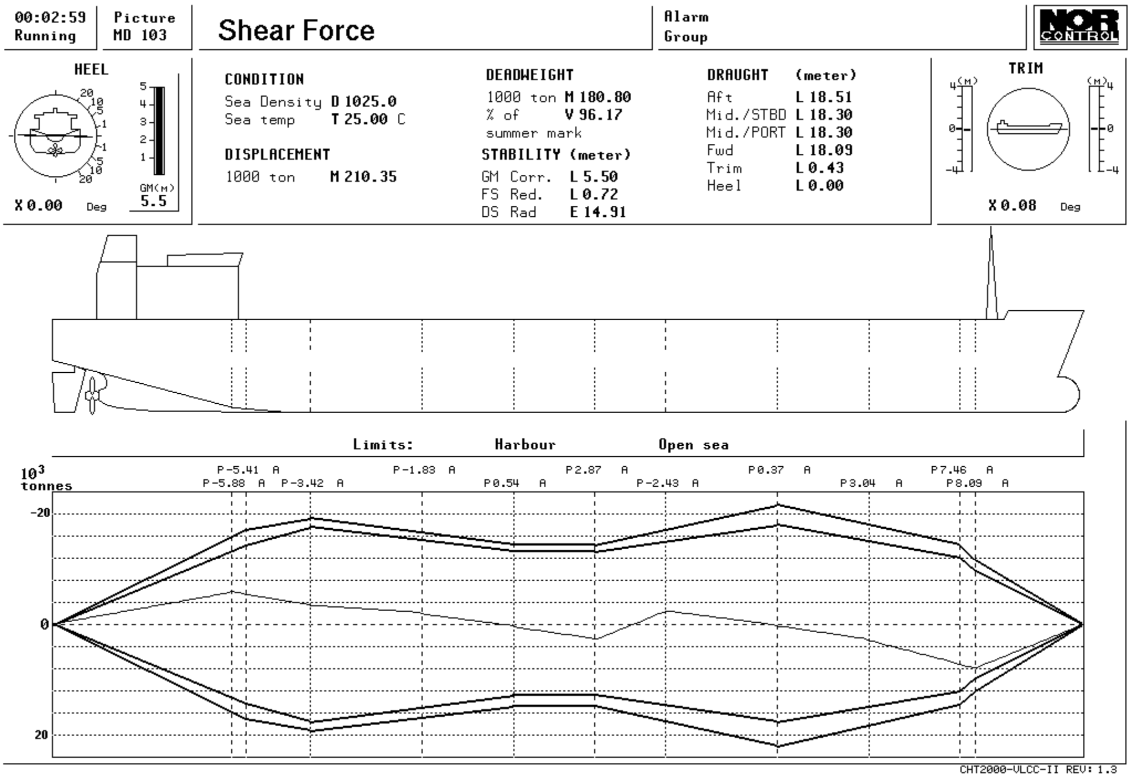
Cargo Baragraph will give the operator a total view of the cargo- and ballast- tanks with information about tank level, flow rate, cargo density and quantity in each tank.

4.5.2 Cargo Survey



The Cargo Survey picture will give an overview of the ullage in the cargo-, ballast- and HFO- tanks. Ship conditions will be dynamic updated based on tank ullage.

4.5.3 Shear Force



The Shear Forces are calculated from the load distribution of the ship including the steel weights of the different hull sections, and the corresponding Buoyancy forms.

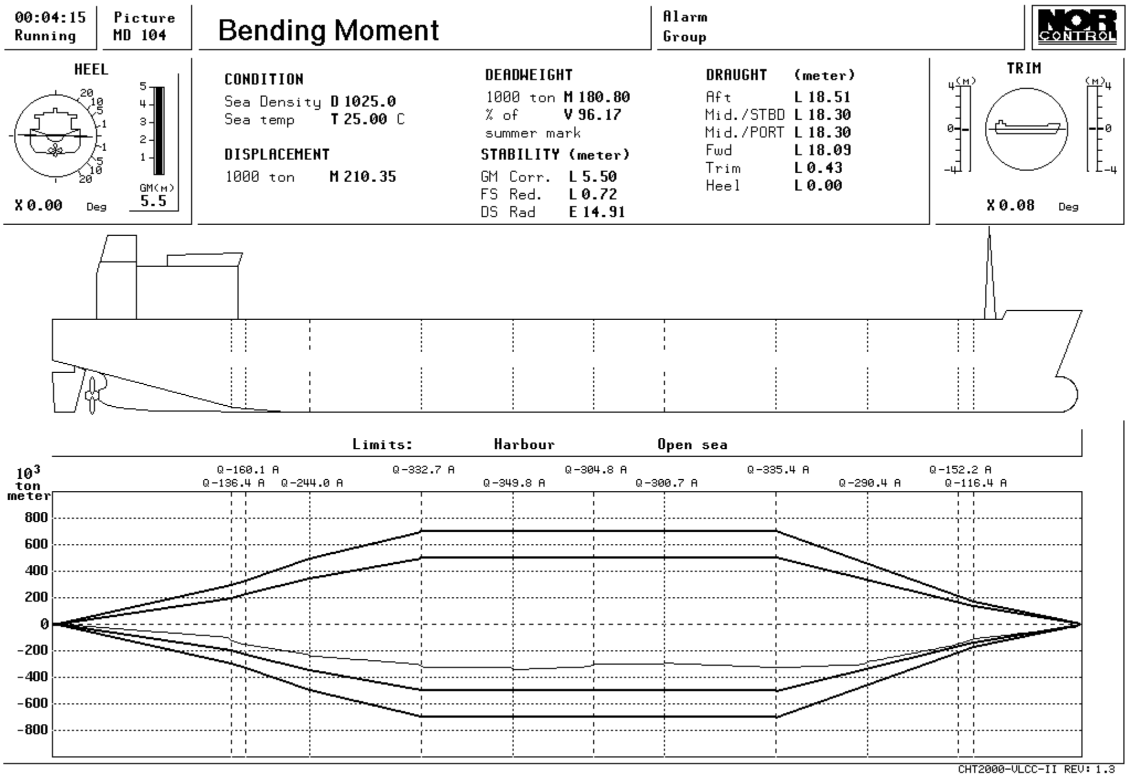
The graphic picture will display three different curves.

- The yellow curve shows maximum permitted shear forces in harbour condition.
- The red curve shows the maximum permitted shear forces in seagoing condition
- The blue curve shows actual shear forces.

The shear forces (P) in each section (0 -12) is expressed in Kilotonnes. Each value is equipped with an alarm that activates when the limit value is exceeded.

The "frame number" is identical to the distance from aft perpendicular to tank section in meters.

4.5.4 Bending Moment



The Bending Moments are calculated from the Shear Force distribution.

The graphic picture will display three different curves.

- The yellow curve shows maximum permitted bending moment in harbour condition.

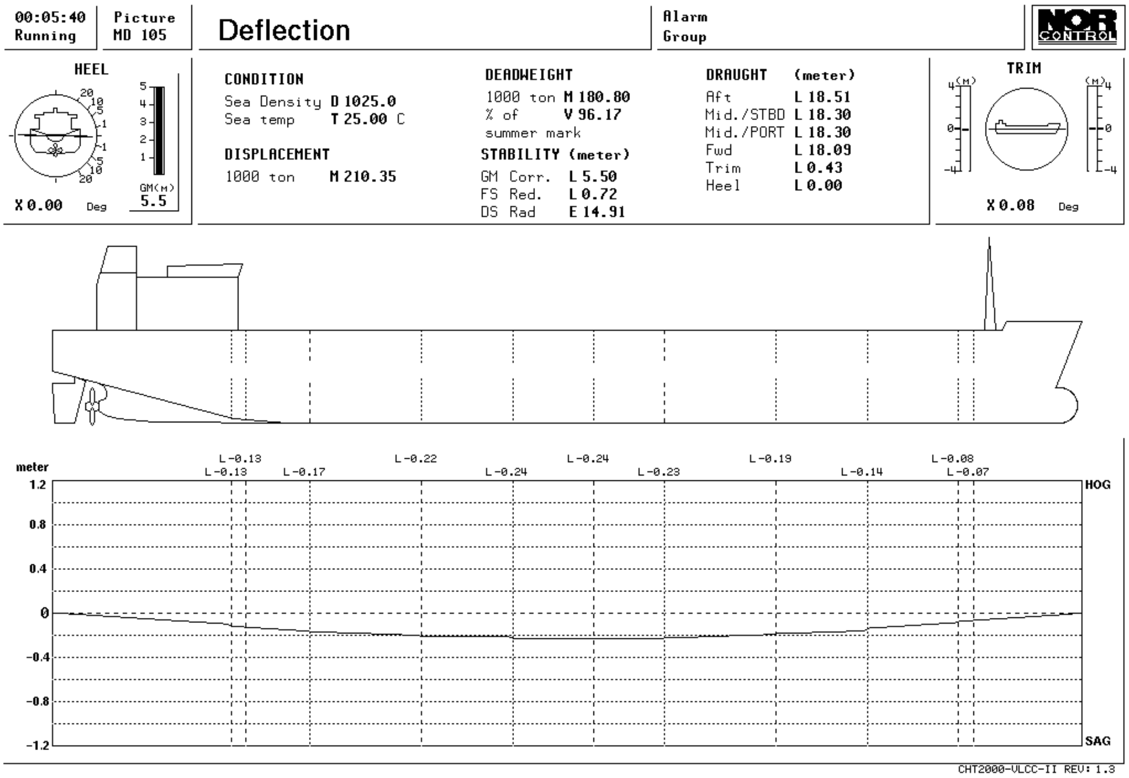
- The red curve shows the maximum permitted bending moment in seagoing condition

- The blue curve shows actual bending moment.

The bending moments (Q) in each section (0 - 12) is expressed in Kilotonnesmeter. Each value is equipped with an alarm that activates when the limit value is exceeded.

Positive bending moments represents hogging condition and negative moments represents sagging condition.

4.5.5 Deflection

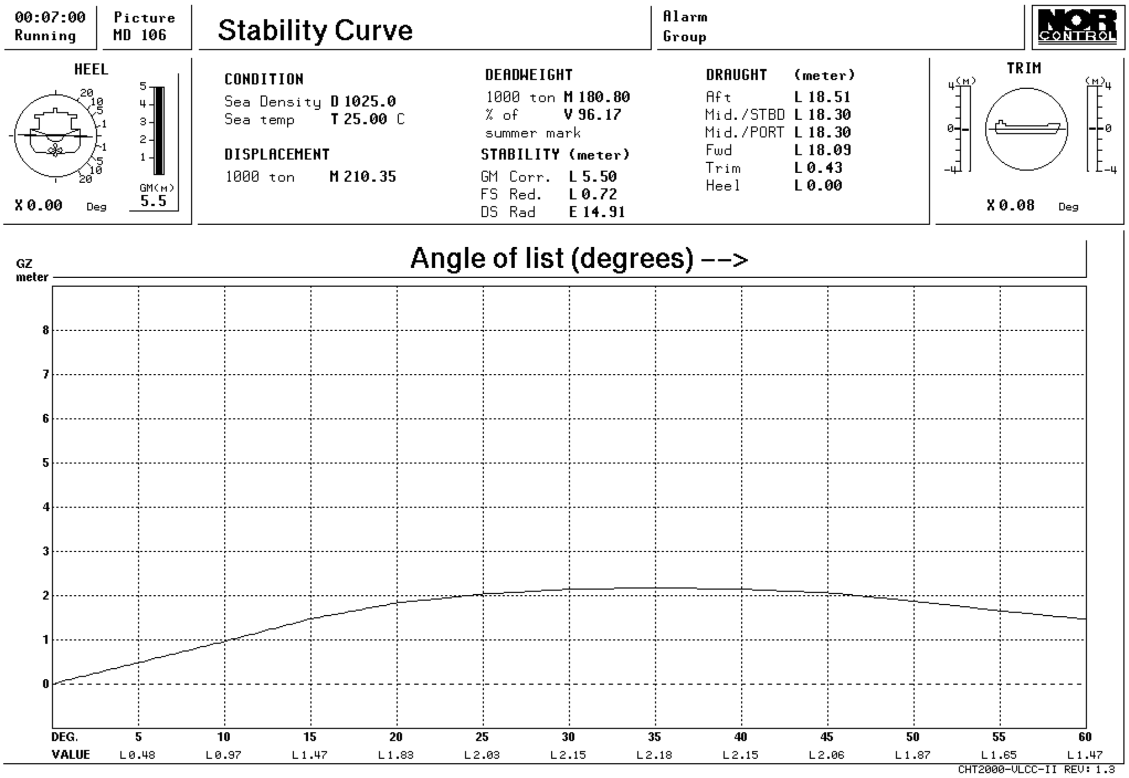


The hullís deflection (from the straight line) is calculated from the bending moments and from the elasticity of each hull section.

The Deflection (L) in each section (0 -12) is expressed in Metres.

Positive deflection represent a hogging hull condition, negative deflection represent a sagging hull condition.

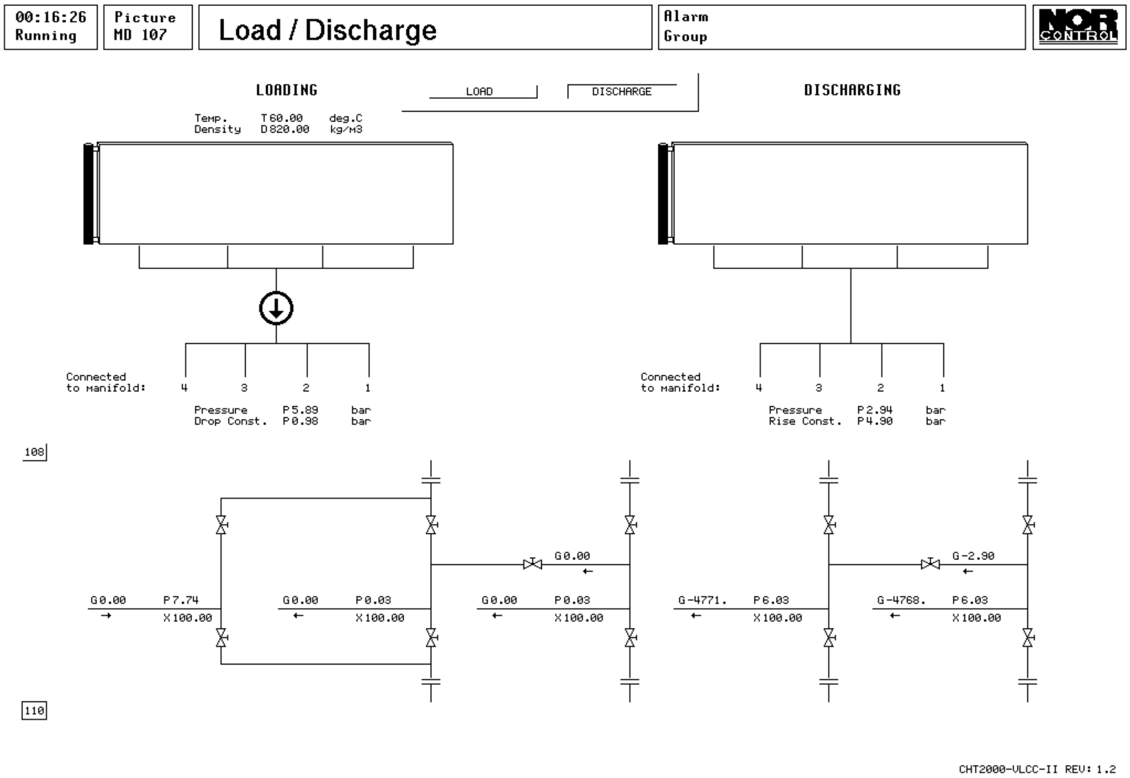
4.5.6 Stability Curve



The stability curve in the form of righting arm values is computed for heel angles ranging from 0 to 10 degrees. From this the meta centric height is computed. All righting arm values are corrected (reduced) for possible "free surface" effects. The reduction in meta centric heights is specifically given (FS Red.).

The area under the stability curve from 0 to 40 degrees representing the Dynamic stability is shown in meter radians (DS Rad).

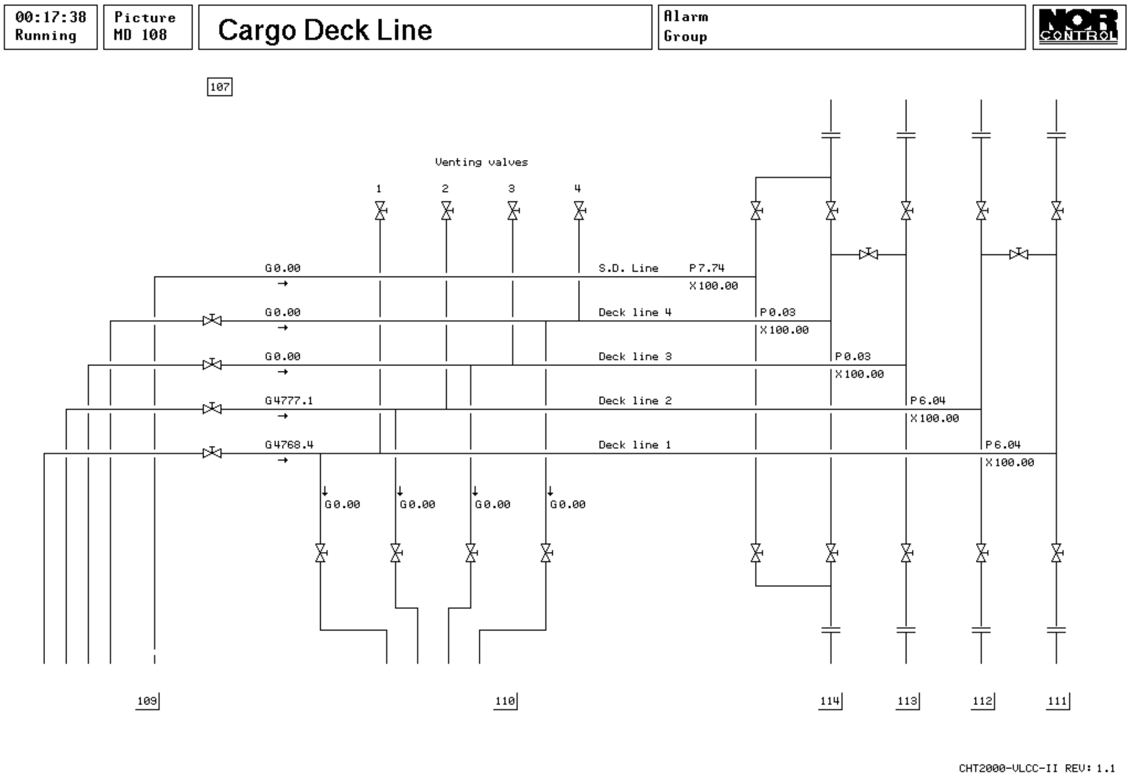
4.5.7 Loading/Discharging



The picture gives information of shore terminal plant. The proper selection (loading/discharging) must be made prior to operation or by the instructor.

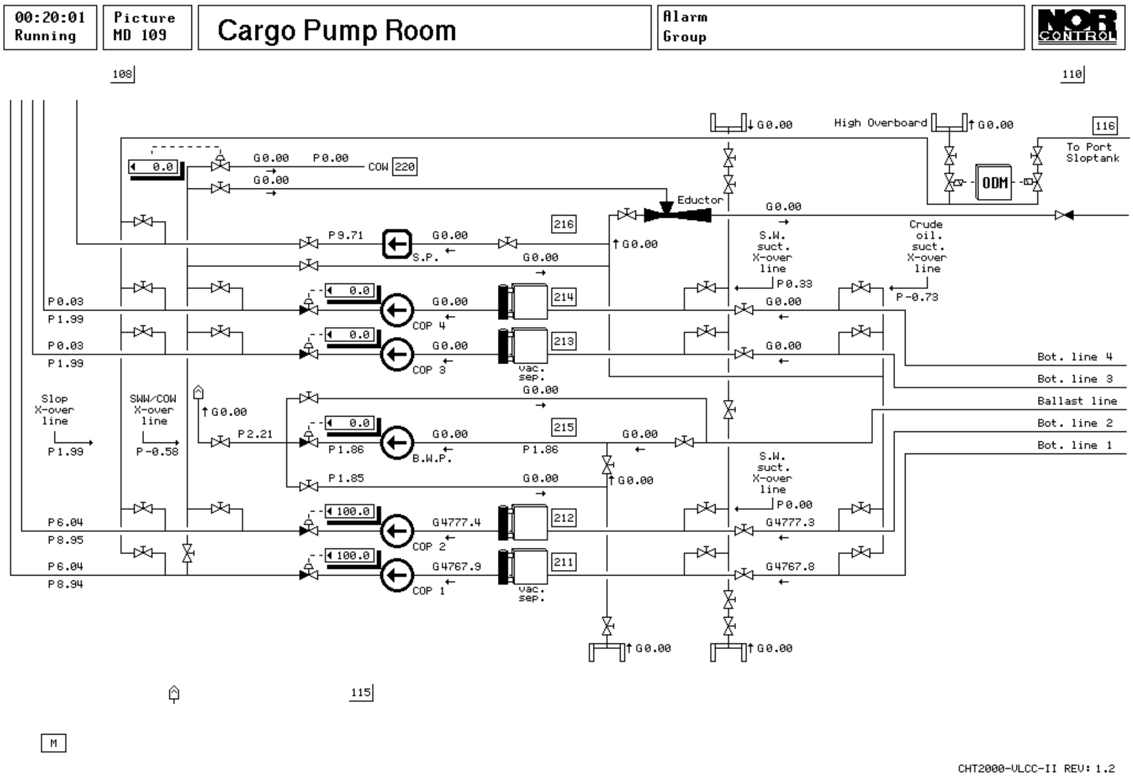
The manifold connections port or starboard must be selected by clicking on the connecting flanges with the left mouse button.
The pressure/flow characteristics of the terminal is set by the instructor, as well as cargo loading temperature and density.

4.5.8 Cargo Deck Lines



The vessel is equipped with 4 main liquid lines, each with a dedicated cargo pump. Depending of number of shore connections available in each scenario, cross connection on the manifold must be selected. From the deck manifolds on port or starboard side the cargo can be routed through pipelines and valves to cargo tanks, or from cargo tanks to pump room and manifolds.

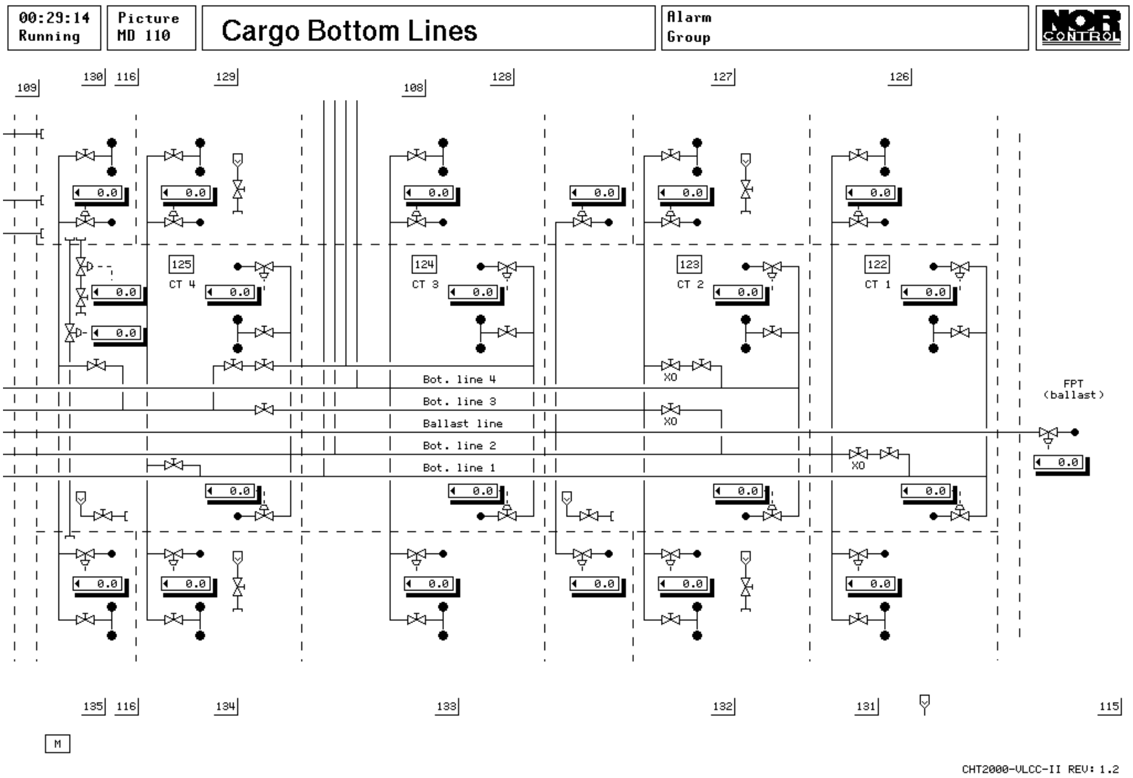
4.5.9 Cargo Pump Room



By clicking the 109 button on the Cargo deck line mimic (MD108), direct access the Cargo Pump Room (MD 109) is obtained. An overall view of cargo pump room. Showing pump room with pumps/valves/lines for cargo- and ballast- handling.

It also include the eductor, stripping pump, oil/gas separator tanks, and oil discharge monitoring (ODM) control valves. From this mimic the pump room routing is performed. Each major component as cargo pumps, ODM, stripping pump, eductor have buttons for easy access to next operating level.

4.5.10 Cargo Bottom Lines

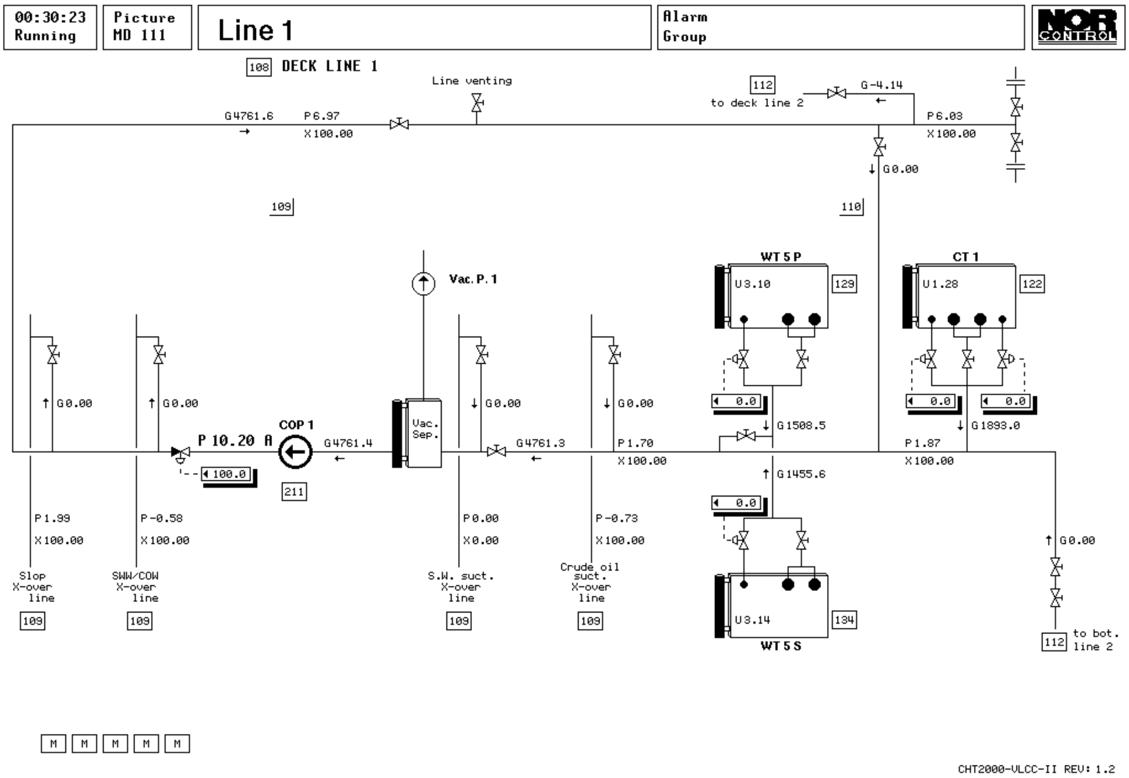


Cargo Bottom Lines (MD 110) contains an overall view of line arrangement in cargo- and ballast tanks.

The system consist of 4 main cargo lines and 1 separate ballast line, all located in the centre tanks. The main cargo lines are interconnected via cross-over lines and isolating valves

Cargo- and ballast- tanks are connected to the main lines via branch pipes and isolating valves. Main- and stripping - suctions (bell-mouths) are located in aft end of the tanks and relatively close to the longitudinal bulkheads in order to obtain maximum out-turn during discharging, stripping and COW'ing.

4.5.11 Cargo Line # 1



Cargo line # 1 is, from the manifold, connected into CT. # 1 and WT. # 5 P&S via the pump room and cargo drop line # 1 and interconnected to line # 2 via branch line and isolating valve located in CT. # 1
From this mimic one will have a full overview of system no 1 during start-up of cargo operations.

4.5.12 Cargo Line # 2

Cargo line # 2 is, from the manifold, connected into CT. # 4 and WT. # 1 P&S via the pump room and cargo drop line # 2 and interconnected to line # 3 via branch line and isolating valve located in CT.2 #.
From this mimic one will have a full overview of system no 2 during start-up of cargo operations.

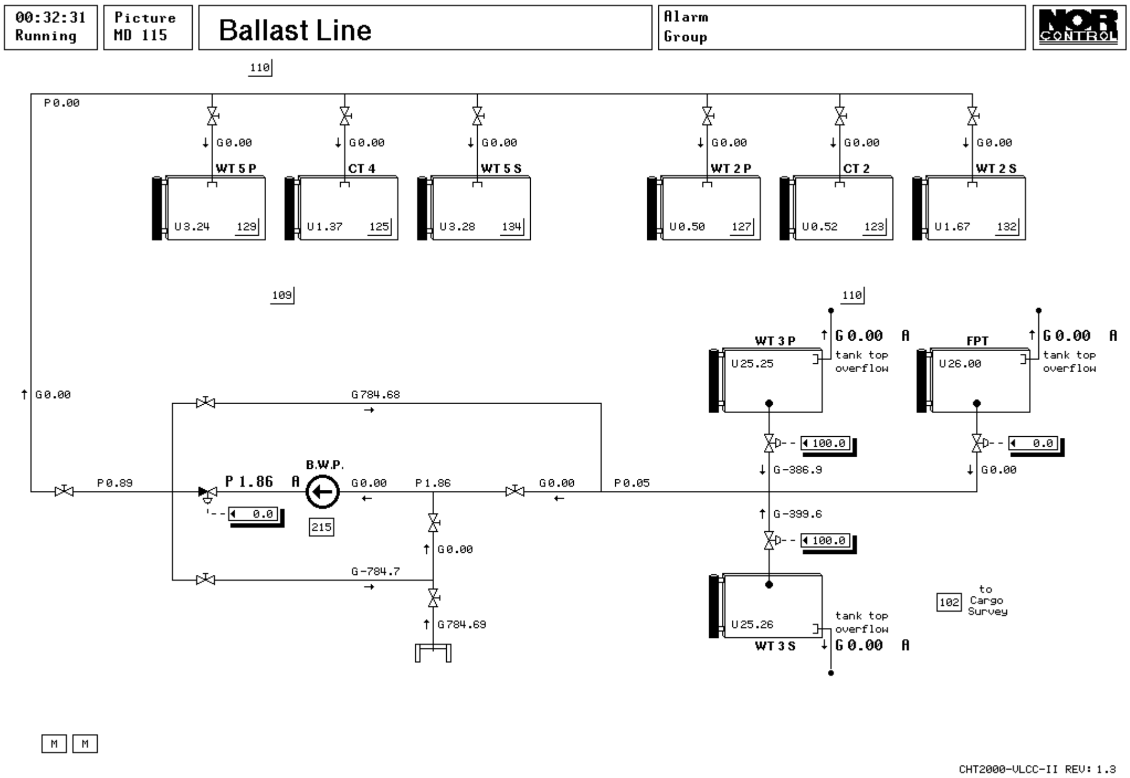
4.5.13 Cargo Line # 3

Cargo line # 3 is, from the manifold, connected into CT. # 3 , WT. # 2 P&S and WT. # 6 P&S via the pump room and cargo drop line # 3 and interconnected to line # 2 via branch line and isolating valve located in CT.2 #. From this mimic one will have a full overview of system no 3 during start-up of cargo operations.

4.5.14 Cargo Line # 4

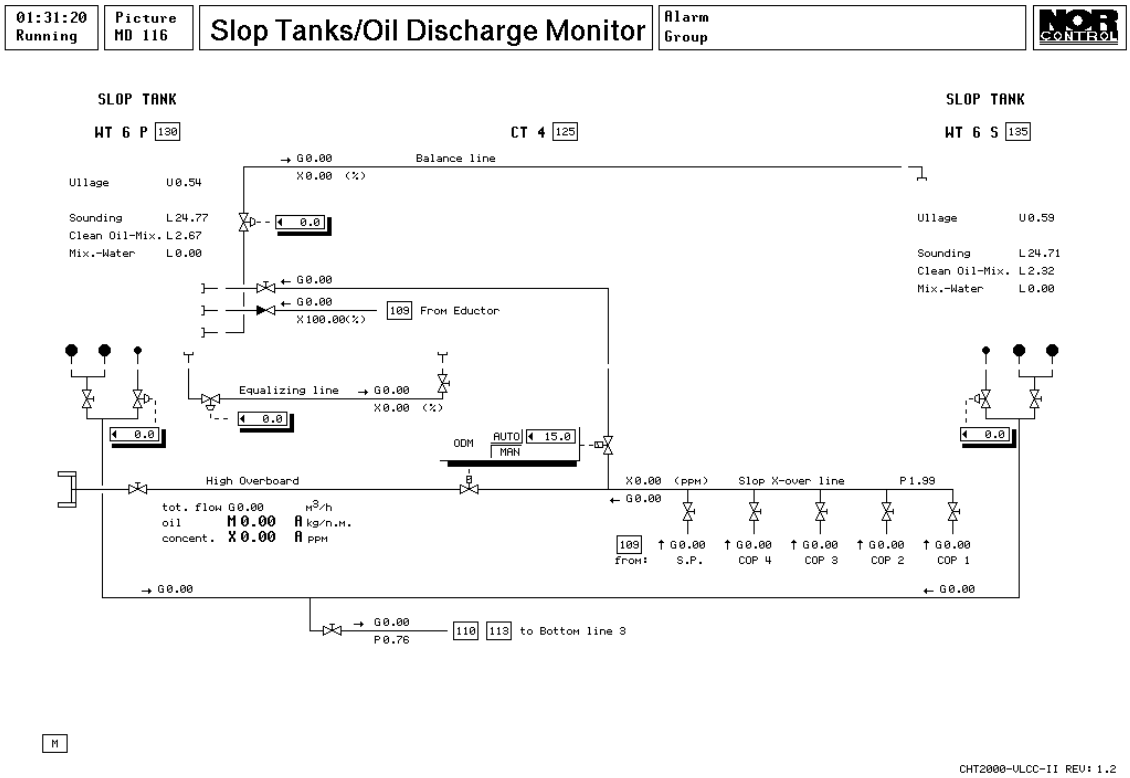
Cargo line # 4 is, from the manifold, connected into CT. # 2 , WT. # 4 P&S via the pump room and cargo drop line # 4 and interconnected to line # 3 via branch line and isolating valve located in CT.2 #.
From this mimic one will have a full overview of system no 4 during start-up of cargo operations.

4.5.15 Ballast Line



The ballast line is, from the pump room, connected into the segregated ballast tanks WT. # 3 P&S and FPT. A separate ballast deck line is fitted for ballasting CT. #2 - 4 and WT. # 2 - 5 P+S. via drop lines.

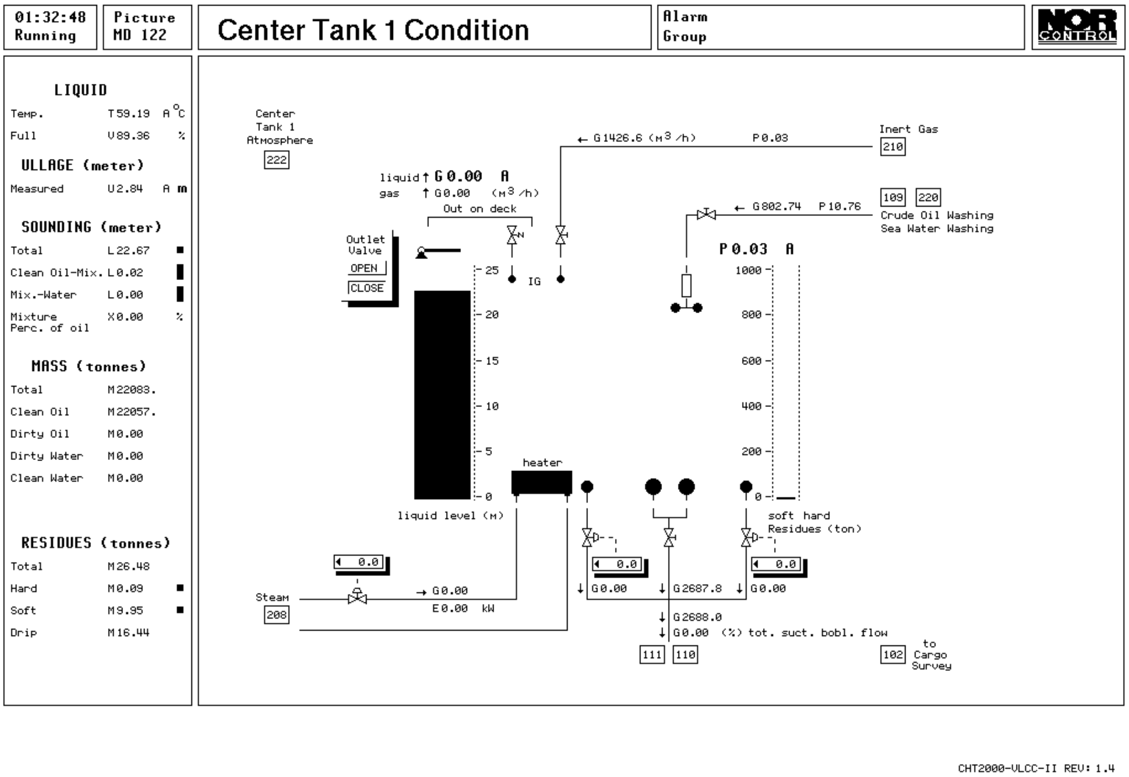
4.5.16 Slop Tanks and Oil Discharge Monitor



The slop system consist of two slop tanks with WT. #6P as primary slop tank and WT. #6S as secondary slop tank. A decanting (balance) line is connected between the two slop tanks and an equalising line connects WT. #6P to CT. #4.

All dirty ballast discharge from cargo tanks is monitored by the ODM (Oil Discharge Monitor), as regarded by IMO regulation. Oil contaminated ballast with more than 15 PPM, will be directed to port slop tank as long as the measured oil content is too high.

4.5.17 Centre Tank 1, 2, 3, & 4 Condition



The centre tank picture gives a detailed description of the tank condition, including the total mass of water, oil or mixture in the tank. Inert gas flow, venting, washing, cow-ing, heating, loading and discharging will be shown in detail to the operator.

There are installed a washing machine in each tank that can be programmed from MD 220. The washing machines are strategically placed in order to minimise shadow effect.

Steam heating coils are fitted in the bottom of each tank and is operated by the cargo heating steam valve.

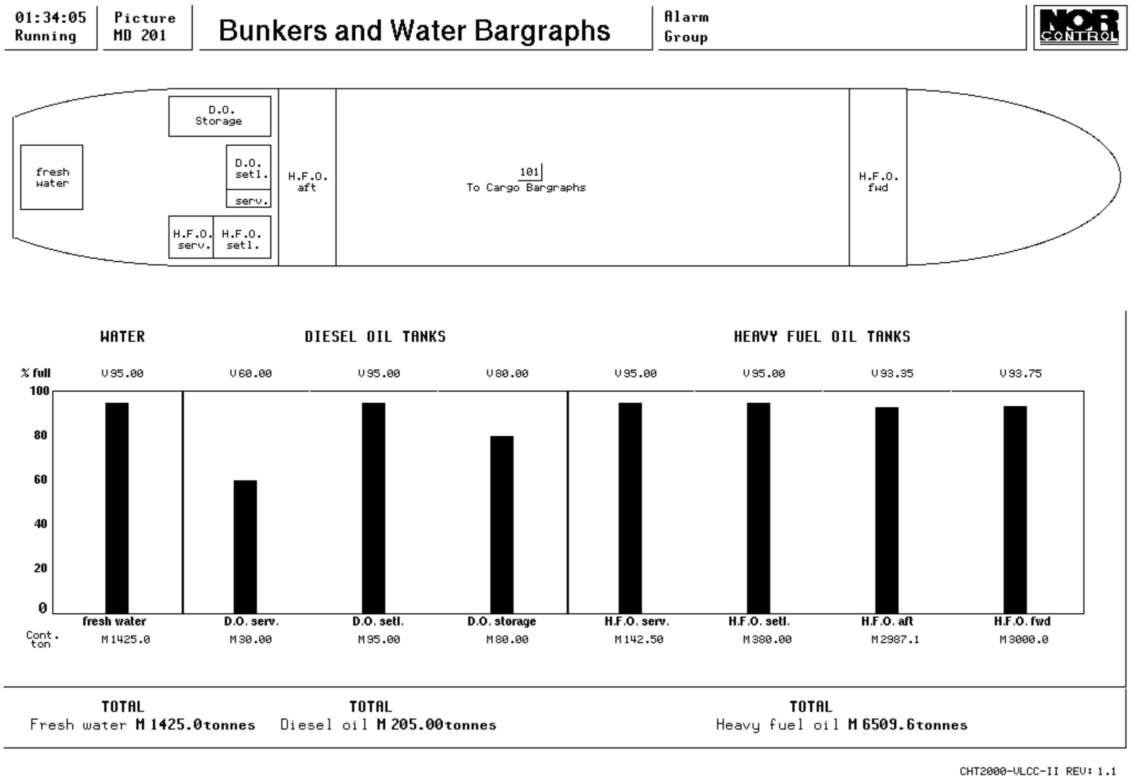
4.5.18 Wing Tank 1, 2, 4, 5 & 6 Port Condition

The tank facilities is the same for port wing tanks as described for centre tanks.

4.5.19 Wing Tank 1, 2, 4, 5 & 6 Stb. Condition

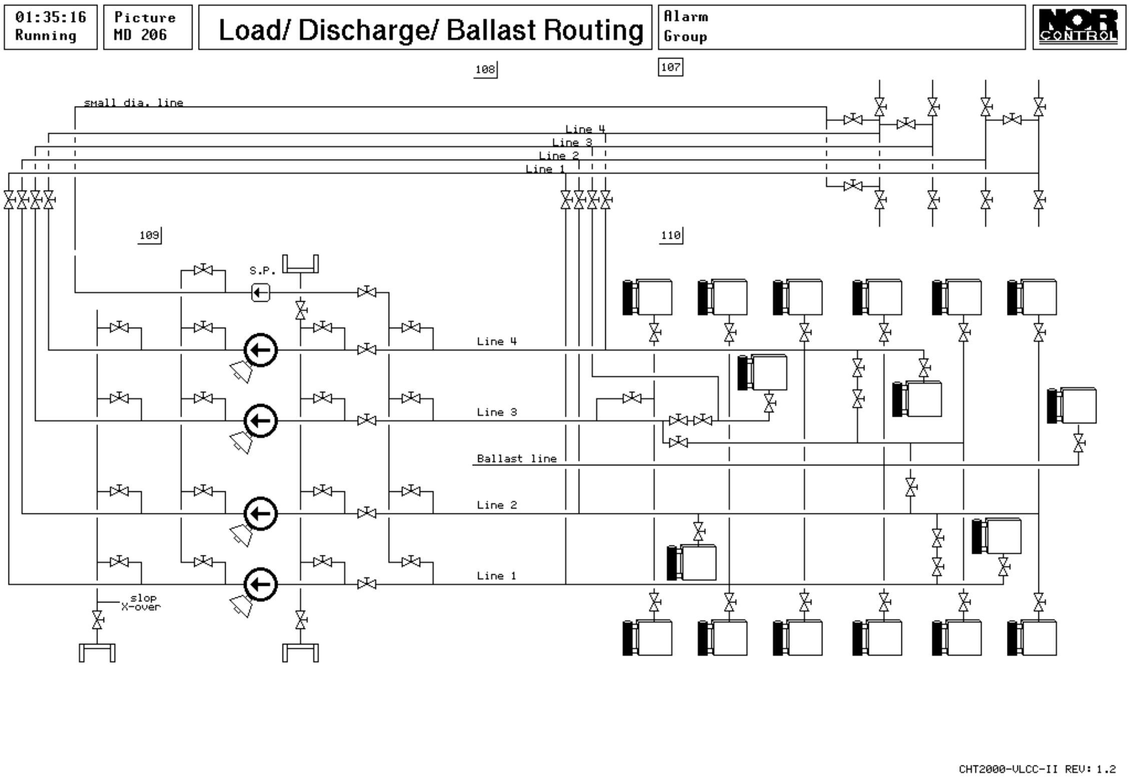
The tank facilities are the same for starboard wing tanks as described for centre tanks.

4.5.20 Bunkers and Water Bargraph



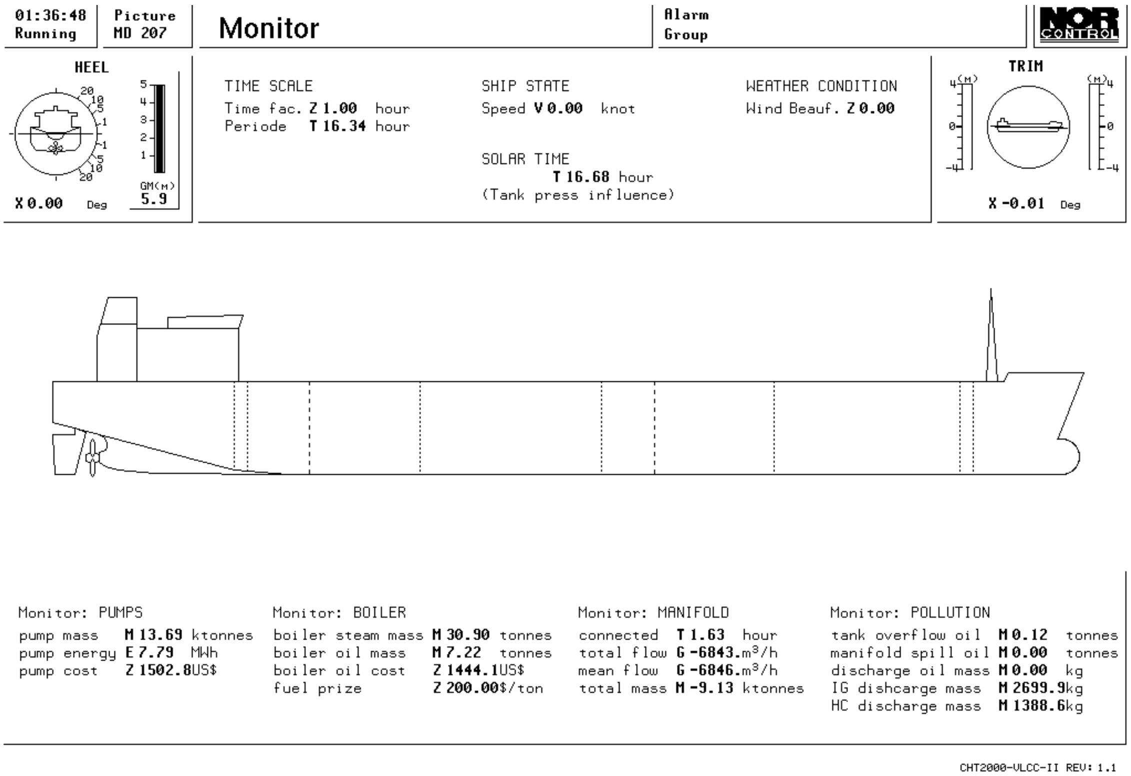
The fresh water tank and the DO/HFO tanks are auxiliary tanks that can be filled/emptied directly from this picture by changing the volume variable (Variable page 0074). Consumption of HFO on the boiler will be from HFO tank aft which reflect the transfer to the aux. tanks. During sea voyage one must transfer HFO from HFO tank fore by starting the transfer pump (Variable page 0073).

4.5.21 Loading / Discharge / Ballast Routing



Loading / Discharging / Ballasting Routing picture shows the operator how pipelines are routed from manifolds and sea chests into the cargo and ballast tanks. This picture is not dynamically updated.

4.5.22 Monitor



Information on the overall cargo handling performance display the :

- Use of energy (pump/heating).
- Amount of pollution (oil spill/hydro carbon/gas waist)
- Efficiency of operation (manifold connection time).

<u>Economical Studies:</u>

The computer accumulates the power consumption during cargo handling operations such as loading, discharging, ballasting, crude oil washing etc.

Power consumption can be measured as:

- Steam consumption in tonnes.
- Oil consumption in tonnes and USD.
- Total energy consumption in MWh.

This feature enables the students to carry out economical studies of the cargo handling operation thus improving cargo handling efficiency.

Pollution Control:

The simulator has an oil monitoring system which continuously measures all liquid pumped overboard.

A preset limit for acceptable oil in the overboard liquid can be set by the operator assuring that no polluted liquid will be pumped overboard.

The computer will accumulate the amount of oil pumped overboard and calculate the amount per nautical mile.

Time Scale:

Time factor is in Normal operating mode set to time factor 1 (Real time). From picture no 1000 (Operating condition) the dynamic response time can be selected. In Fast mode the dynamic response time will have time factor 5 and in Very fast mode the factor will be 20.

Period:

The simulation period will be the result of actual simulation time multiplied by the time factor from when the operating mode was selected.

Ship state:

The ship speed can be set from the Variable page 0003 (Sea/Ship state). During loading/discharging operations this should be set to zero. The speed will have effect on the HFO consumption, the trim, the cargo temperature and the ODM when in use.

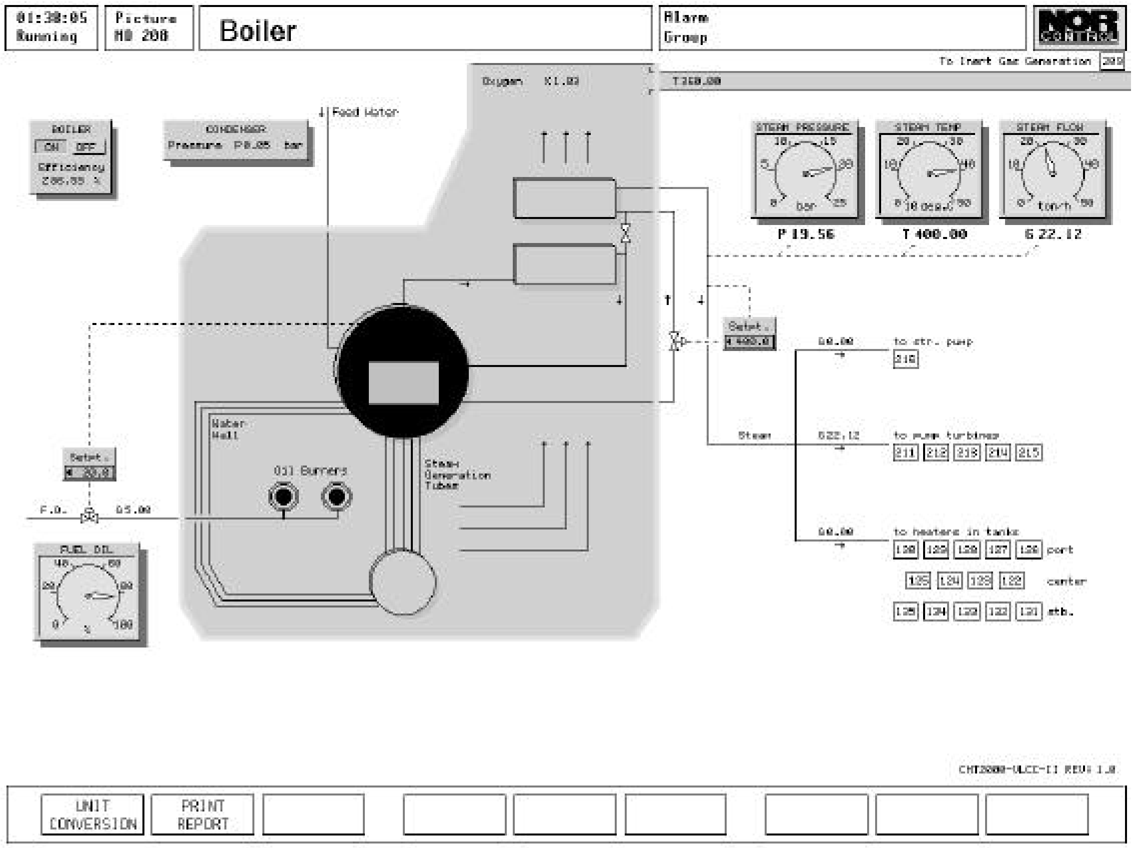
Weather condition:

The weather condition is selected from the Variable page 0003 (Sea/Ship state). Condition is selected by entering wind force 0 - 12 after the beaufort scale. The weather condition will have influence on HFO consumption, trim and heel (rolling), shear forces, deflection and ullages in the tank with cavitation of pumps if cargo-transfer or COW operations is in progress. It will also have effect on the stratification (mixing) of oil and water in the tanks.

Solar Time:
The Solar time is automatically following the Period in a 24 hour cycle and will begin at zero if not manually selected otherwise. The solar time can be manually set in the Variable page 0003 (Sea/ship state). The Solar time will have influence on the vapour

pressure in the cargo tanks based on the temperature leakage from day/night effect.

4.5.23 Boiler

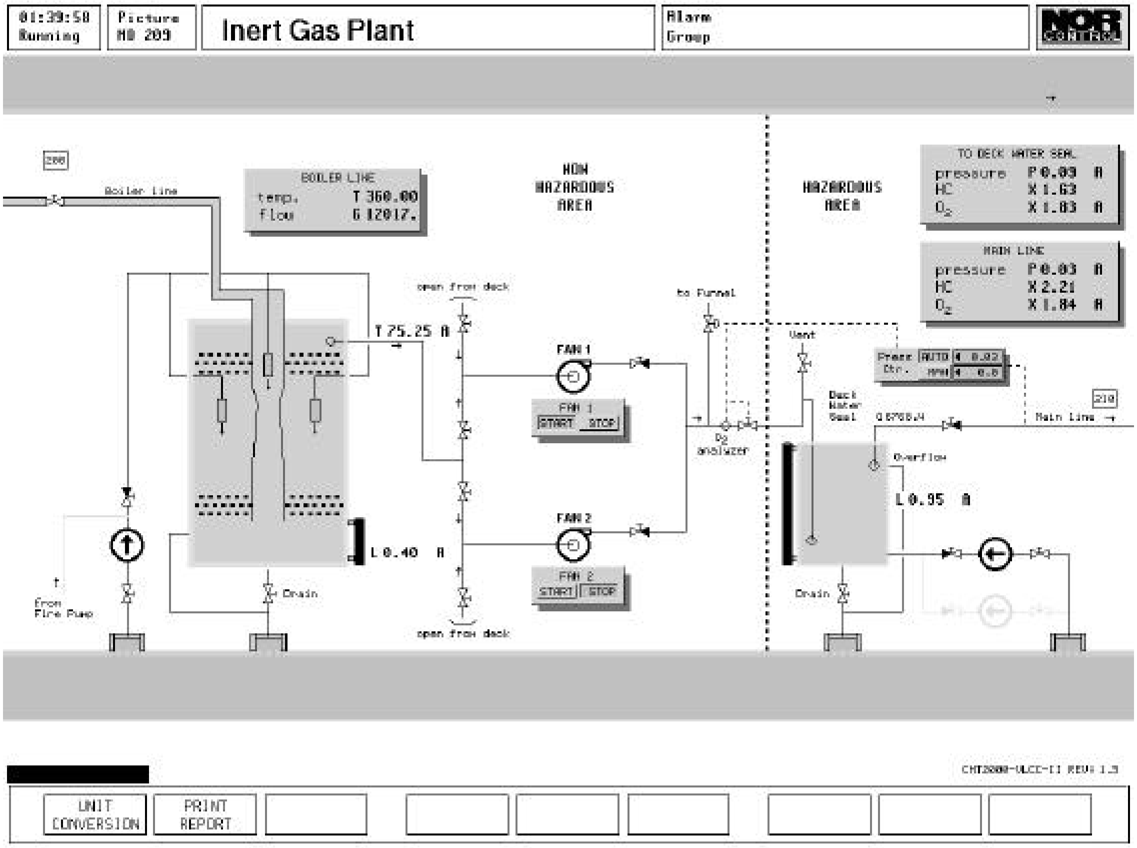


The oil fired boiler is equipped with two steam atomising oil burners that can produce approximately 50 ton/hour steam at 15 bar and 410 ^{o}C.

When the boiler is started it will automatically purge, ignite and open for fuel, regulate the water level etc. Steam consumers are steam driven pumps and heaters in cargo tanks. The flue gas from the boiler is also used for Inert Gas production.

The boiler can be isolated from the variable page no 0081 (Steam boiler control data). This will allow all aux. systems to operate without the boiler active.

4.5.24 Inert Gas Plant



The cargo handling simulator is modelled with a steam boiler where flue gas is taken from the boiler uptake and directed through the scrubber, fans, and deck water seal to the main inert gas deck line.

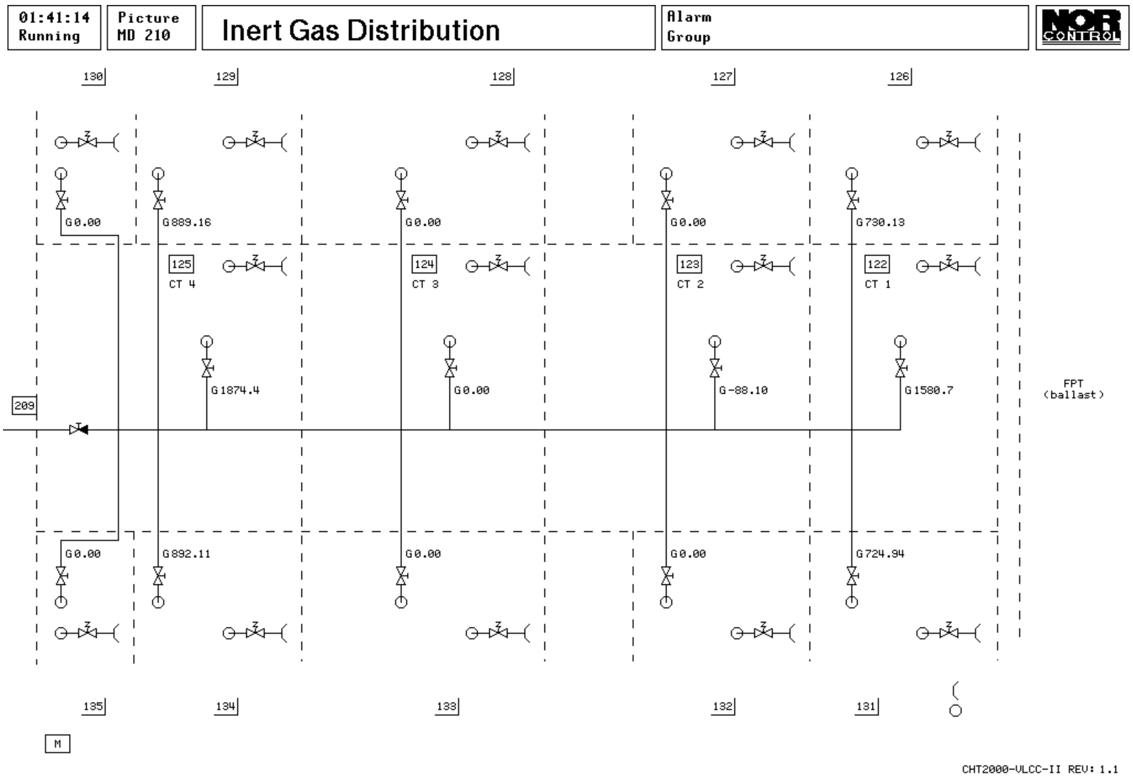
The capacity of the inert gas plant is approximately 40,000 cbm/h, provided sufficient flue gas is available from the boiler. Flue gas is produced by steam consumption to aux. systems.

The scrubber washes and cools the flue gas in order to reduce soot and SO_2 content. The oxygen content will variate with the boiler load.

In order to avoid O_2 exceeding 5% to enter the tank, an automatic valve will close and route the fluegas to the funnel. Another valve controlling the mainline pressure will also regulate the flow to the tanks by bypassing to the funnel.

For ventilation purposes the system can be used by opening ventilation valves from deck. This will automatically shut off the fluegas suction valves in order to avoid mix.

4.5.25 Inert Gas Distribution.



Each cargo tank is via branch lines and isolating valves connected to the main inert gas line.

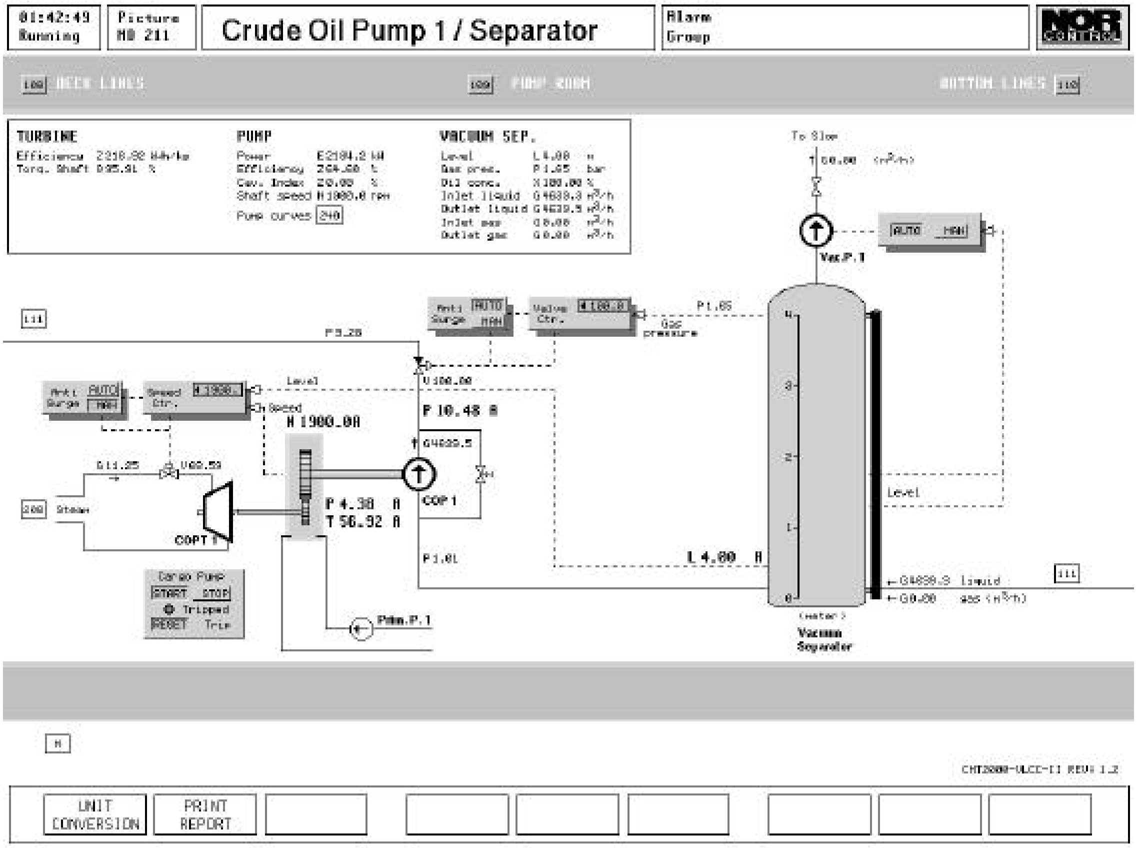
The oxygen content in the inert gas is dependent on the boiler load and the boiler combustion control.

The mixing process between the hydrocarbon gas content in the tank and the incoming inert gas flow is modelled giving the average content of oxygen and hydrocarbons in the tank at any time.

The effect of temperature variation (night/day) on the tank pressure and the effect of the tank's "constant pressure/vacuum " is modelled. A P/V valve is provided on each tank..

The inert gas plant is fitted with two air inlets, one for each fan, allowing the plant to take air instead of flue gas for ventilating and gas-freeing cargo tanks.

4.5.26 Cargo Oil Pump 1, 2, 3 & 4 and Separator



The cargo pumps are modelled as steam driven centrifugal pumps. The pump model is of a general type and can represent any type of centrifugal pumps.

Each cargo pump is equipped with an oil/gas separator for stabilising the pump suction head and reduce cavitation during the last phase of emptying the tank (stripping operation).

For the cargo pumps, special attention is paid to the simulation of possible cavitation during stripping operations, in connection with low suction head.

Running:

Increase/Decrease
The set-point of the pump turbine governor, which regulates the pump speed, is controlled by enter a new value into the controller.

Open/Close
The discharge valve setting is controlled by means of a new value.

The pump flow and the pump discharge pressure are controlled by the pump speed setting and the discharge valve setting.

High Bearing Temp.

Running of the pump at a substantial speed against a high discharge pressure may cause high bearing temperature after a certain period of time, even if the pump is equipped with a recirculation safety valve.

The performance of the pump turbine depend on the steam supply pressure and temperature, as well as the condenser vacuum. These parameters will vary with the pump turbine load.

Cavitation

If the suction head is too low the pump will start to cavitate. The critical suction head for cavitation will be dependent on the vaporising pressure of the liquid to be pumped and the current NPSH (Net Positive Suction Head) of the pump. This phenomena will occur on the cargo pumps, but not on the ballast pump.

4.6 MODELLING OF PUMP CHARACTERISTICS

The relationship between discharge head, flow and pump speed of a centrifugal type pump can be described as follows :

$H = k_0n^2 \quad + \quad k_1\,nq \quad + \quad k_2\,q^2$

H = discharge head (delivery press.)
n = relative pump speed
q = relative volume flow

k_0 , k_1, and k_2, are design related constants

The model variables H, n and q are currently and dynamically up-dated during the simulation, while the model constants $k_{0,}$ k_1 and k_2 have to be set initially, thereby designing the performance and the capacity of the pump.

The relationship between pump torque, pump speed and pump flow can be described as:

$T = t_1n^2 + t_2nq + t_3q^2 + t_4$

T = pump torque
n = relative pump speed
q = relative pump flow

$t_{1,}$ t_2, t_3 = design related constants
t_4 = static friction constant.

For demonstration purposes the design related model constants of pump no.l can be changed.
Ref. Model Variable Directory, page no.11. Cargo Pump 1 Design D a t a .

The power received from the Pump turbine can be expressed as:

$P_{IN} = T \times N$

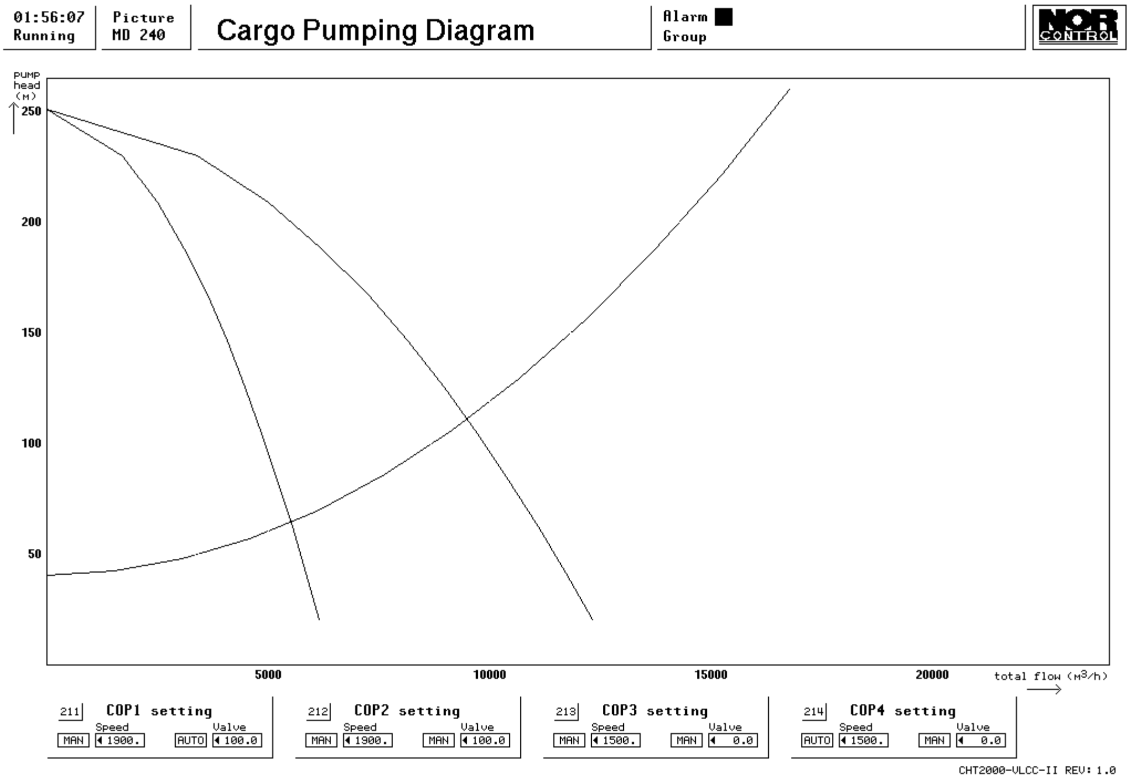
while the power transferred to the liquid pumped can be expressed as:

$P_{OUT} = H \times q$

The pumps hydraulic efficiency can then be expressed as :

$$n_h = \frac{P_{OUT}}{P_{IN}}$$

4.7 Cargo Pumping Diagram



In the Cargo Pumping Diagram the actual pump and system curve are presented. The curves are automatically updated when pump head pressure is increased or decreased, RPM is changed, more pumps are started in the system and the NPSH value is changed due to increase in tank levels. The pump RPM and discharge valve setting on each cargo pump can be operated from this mimic in order to optimise the pumping operation. When a change is made, new curves will appear leaving the previous curves dotted in order to analyse the variation.

4.8 Oil/Gas Separator With Vacuum Pump

The vacuum pumps can be run in auto or manual mode. The cargo pumps are fitted with oil/gas separators with vacuum pumps. The vacuum pump is started automatically at low liquid level in the separator. The state of the vacuum pump is shown by medium colour on the pump. However, if the liquid level in the oil/gas separator gets too low, vapour or air will enter into the pump and cause lost pumping capability and pump over-speed. This will be the case if the vacuum pump does not start automatically at low level. (Can be demonstrated by setting the vacuum pump in MANUAL).

Speed Surge Control

In Speed Surge Control mode the pump speed set-point is limited automatically by the liquid level in the oil/gas separator. I.e.: When the liquid level is reduced, the pump speed set-point is reduced accordingly, over-riding the manual speed setting.

Flow Surge Control

In Flow Surge Control mode the discharge valve opening is adjusted automatically by the pump suction pressure in the oil/gas separator. I.e.: When the pump suction pressure drops, the discharge valve opening is reduced accordingly, over-riding the manual speed setting.

The Speed Surge Control and the Flow Surge Control can be set simultaneously.

Tripping:

If certain critical conditions occur, the pump will trip, i.e.: the pump turbine steam supply valve is automatically closed. The pump will consequently loose its power and stop after a while. Alarm will be given.

Reset Trip

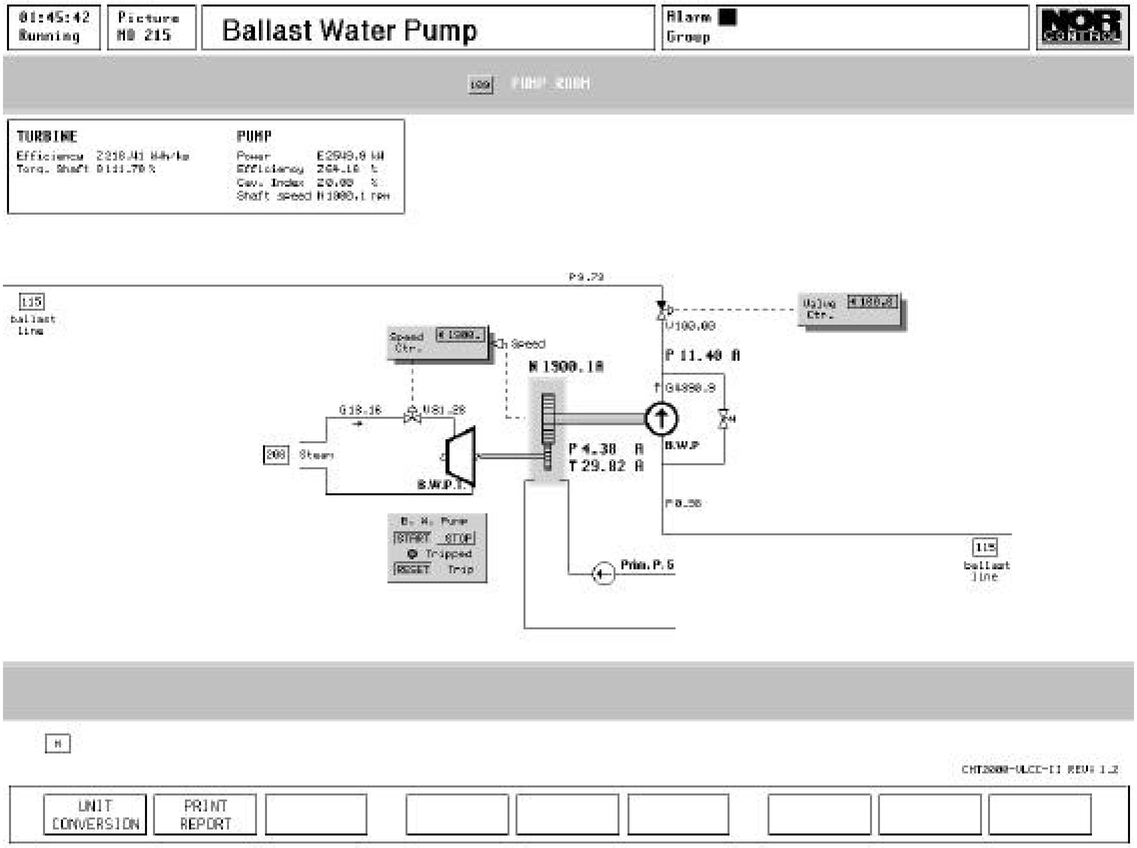
Before the pump can be re-started the trip has to be reset.

Trip Causes

The cause for the trip may be printed out on paper, and it can be identified on the VDU display.

The trip causes are:
No. 1: Overspeed.
No. 2: Pressure low.
No. 3: Temperature high.
No. 4: Discharge pressure high.
No. 5: Inert gas pressure low-low (cargo pumps only).

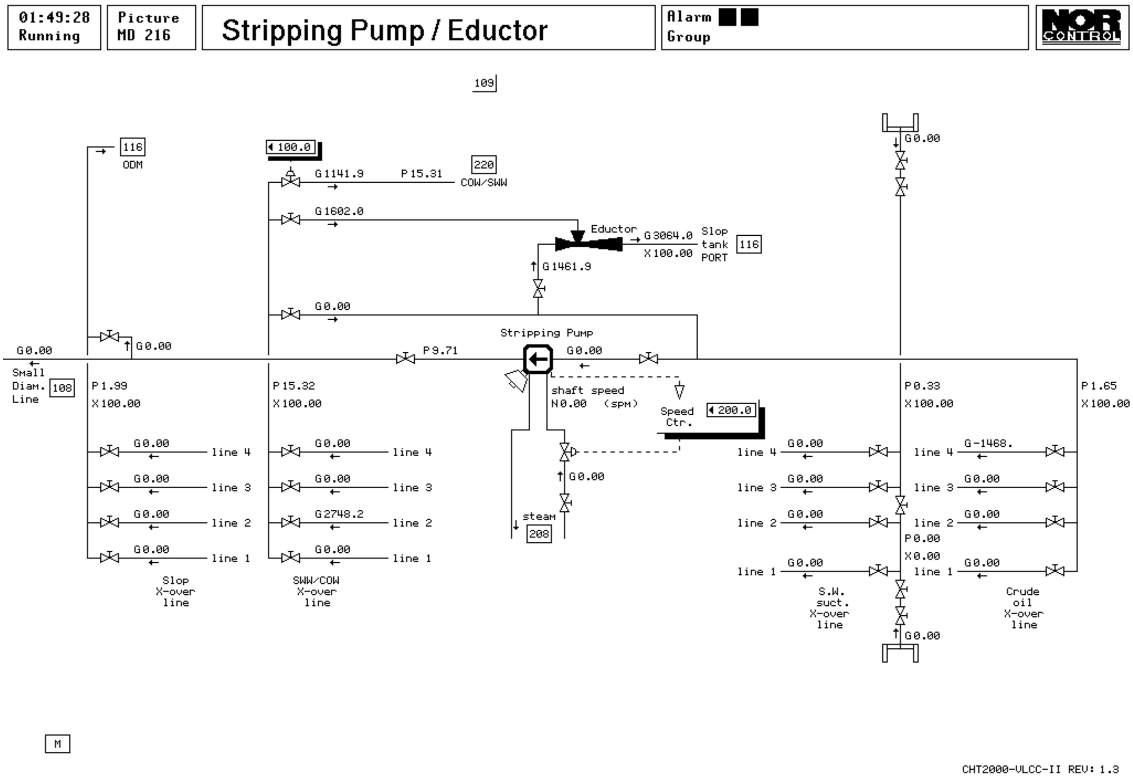
4.8.1 Ballast Water Pump



The ballast pump is modelled as steam driven centrifugal pump. The pump model is of a general type and can represent any steam driven centrifugal pump.

The pump drive unit is modelled to be steam driven turbine, discharging the steam to a vacuum condenser.

4.8.2 Pump Room Cross-over Lines / Stripping Pump / Eductor / Tank Cleaning Heater



The picture gives an overview of cross-over lines, stripping pump, and eductor in the pump room.

There are 4 cross-over lines. The cargo cross-over line connects the 4 cargo lines and the stripping line together.

The sea-water cross-over line connects port and starboard sea chest to each of the cargo lines or COP.

The tank cleaning/COW cross-over line makes it possible to connect any of the cargo lines/COP to the tank cleaning/COW line, small diameter line, stripping pump and eductor.

The slop cross-over line connects each of the cargo lines and the stripping line (small diameter line) to the slop tanks and to port sea discharge via the ODM.

The stripping pump is of steam driven piston type. To start, simply open the steam supply valve in addition to necessary valves on the cargo side.

4.9 Modelling of Stripping facilities

The Stripping Pump:
The reciprocating stripping pump is driven by steam. I.e.: Steam supply Pressure has to be available to the pump before it is started.

Speed Setting
The speed setting of the stripping Pump governor is set by the instructor.
The speed control valve will then vary according to the steam supply pressure, the back pressure and the flow.

Small Diameter Line .
The stripping Pump delivers normally to the Small Diameter Stripping Line, but can be connected to the slop tanks.

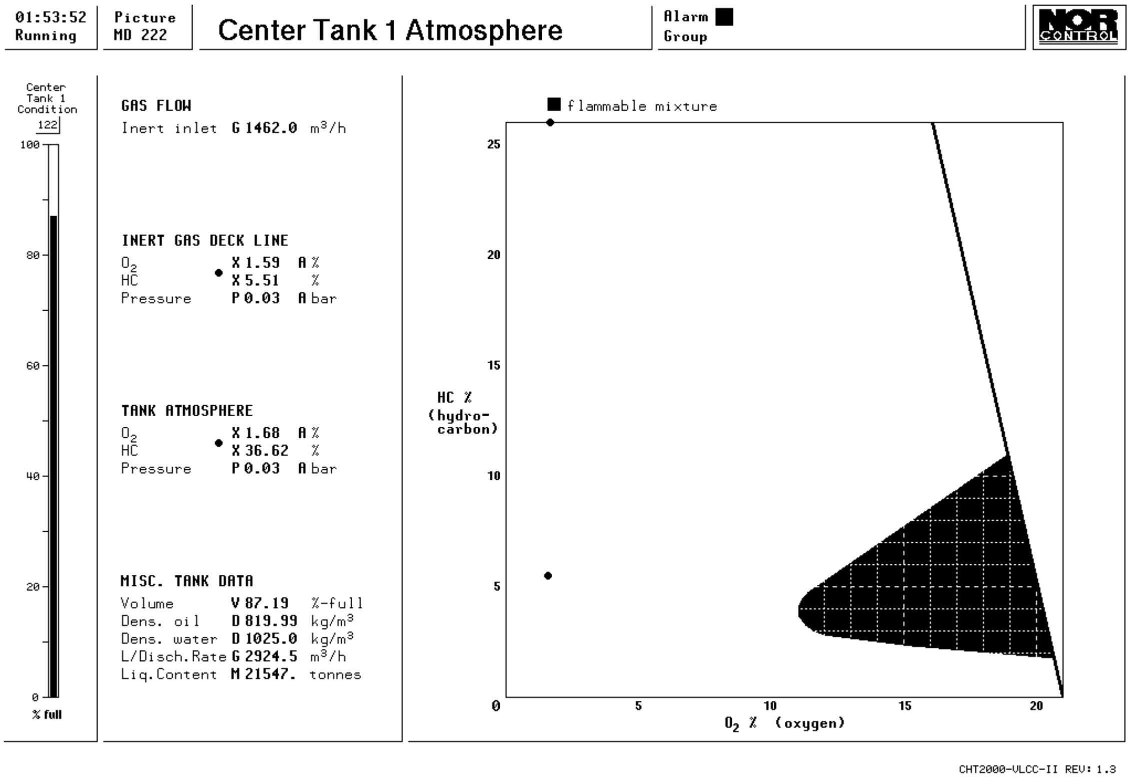
The Eductor:
The eductor works on the principle that the total sum of energy in a liquid flow is constant (Bernoulli's law).
When the liquid flows from A to B, and when it is constricted in C, a higher velocity is gained in this point. The kinetic energy will then increase in this point, too. Because of the fact that the total sum of energy is constant, the static energy is reduced accordingly, yelding a lower static pressure in this point. This will create a suction if a pipeline is connected. The principle is shown in the figure below.

The suction flow to the eductor is dependent on the suction head, the driving flow and the back pressure. The eductor delivers always the driving fluid and the suction fluid to the port slop tank.

The Deck Line Venting Cocks:
The deck line venting cocks are opened and closed from the deck. These cocks have to be open to get the deck lines properly drained.

The Stripping valves:
Separate stripping valves are located in the tanks. These valves are located closer to the bottom and closer to the bulkheads than the main bottom valves Low liquid level in a tank may cause influx of air into the pipelines if the main valve is kept open.

4.9.1 Tank Atmosphere



Modelling of the Tank Atmosphere.

The vapour content in the tanks comprises inert gas and hydrocarbon gas.

The content of inert gas can be read absolutely (mass of inert gas). The content of oxygen (%) can be read as a relative part of the inert gas. The content of hydrocarbon gas can be read either absolutely (mass of hydrocarbon gas) or relatively (hydrocarbon gas, %).

Oxygen Content:

The relative content of oxygen (%) in a tank will be the result of the mixing between:

- Actual content of oxygen in the tank.
- Total mass of inert gas in the tank.
- Oxygen content of the inert gas flow inserted into the tank.
- Inert gas flow rate.
- Air flow rate through the P/V-valve (if vacuum).

Hydrocarbon Gas Content:

The generation of the hydrocarbon gas will be dependent on:

- Amount of crude oil present in the tank.
- Partial pressure of the hydrocarbon gas in the tank.

Vapour Pressure:

The total vapour pressure in a tank is modelled according to the universal gas laws. The vapour pressure will be dependent on the vapour volume in the tank, the mass of vapour and the temperature of the vapour in the tank.

Vapour Temperature:

A regular fluctuation in the vapour pressure caused by the temperature fluctuation between day and night is modelled. The solar time can be set from the instructor station.

Vapour Volume:

The vapour volume will be dependent on the liquid level in the tank.

Mass of Vapour:

The mass of vapour will be dependent on:

- Input flow of gas from the IG-plant and/or the P/V-valves.
- Output flow of vapour through the P/V-valves.
- Generation of hydrocarbon gas.

4.9.2 Oil/Water Settling

The mixture of oil and water in a tank will after a while, due to difference in specific gravity, lead to a stratification process. The content of oil will be on the top, while the water will descend to the bottom.

The stratification of an oil/water mixture will then lead to segregation into three kinds of masses:

- Clean oil (on the top).
- Dirty oil/dirty water emulsion (in the middle).
- Water (on the bottom).

The settling process will be speeded up when:

- The difference in specific gravity is increased.
- The tank temperature is increased.

The mixing process will be intensified when:

- The shipís speed is increased.
- The roughness in the weather is increased.
- The input flow to the tank is increased.

4.9.3 Liquid Tank temperature

The actual liquid temperature in the tank will affect the settling rate. The liquid temperature can be changed initially by the instructor, but will be dynamically updated based on heat-balance, with the following relevant factors included:

- Mass of the liquid.
- Specific heat of the liquid.
- Sea water temperature.
- Temperature in levels in the adjacent tanks.
- Shipís speed.

4.9.4 Modelling of Residues

When the crude oil has been stored in the cargo tanks for a certain period of time, deposits of residues will be the result.

Three types of residues have been modelled: hard residues, soft residues and drip residues. The formation and distribution of residues will be dependent on the state of operation.

- Carrying Crude Oil in the Tank:
  Soft residue - Hard residue (gradually over time).
- Carrying Ballast Water in the Tank:
  Soft residue - Hard residue (gradually over time).
  Soft residue - Dirty water (gradually over time).
- Reducing Crude Oil Level in the Tank (Discharging):
  Clean oil - Drip residue (instantly).
  Drip residue - Clean oil (gradually over time).
- Increasing Crude Oil Level in the Tank (Loading):
  Drip residue - Clean oil (instantly).

- Crude Oil Washing:
  Washing oil - Drip residue (quick increasing).
  Hard residue - Clean oil (gradually over time).
  Soft residue - Clean oil (gradually over time).
  Drip residue - Clean oil (slowly over time).

NB. The COW efficiency is dependent on pressure of the washing media.

- Tank Cleaning (Water Washing).
  Washing water - Dirty water (ref. settling).
  Hard residue - Clean oil (very slowly).
  Soft residue - Clean oil (gradually over time).

NB. The water washing efficiency is dependent on pressure and temperature of the washing water.

CARGO HANDLING TRAINER

CHT2000-VLCC-II-ws

Chapter 5

Operation

5. OPERATION OF THE CHT2000-VLCC-II-WS

Introduction

This Chapter describes the operation of the Training and evaluation control (TEC2000), basic cargo handling principles and operations, general "Cargo Operationî and documents standard procedures for loading, discharging and inerting of the CHT2000-VLCC-II-ws**.**

The normal cycle of tanker operation comprises loading, laden voyage, discharging, ballasting, ballast voyage, tank cleaning, ballast shifting and reloading.

Loading is accomplished by following directions given in the ship's loading orders.

Discharging is accomplished by discharging the cargo directly into a terminal tank storage area, or into a tank barge for further transport. During the discharging procedure, the vessel may also effect the COW procedure.

Ballasting is a process whereby sea water is taken aboard into the cargo tanks or into segregated ballast tanks to ensure proper propeller immersion and to provide good manoeuvring and sea-keeping characteristics.

5.1 TEC2000 Graphic Workstation

The following pages will describe operation of the tracker-ball, the HP keyboard, the Instructor-, the Alarm- and the Operator sections.

5.1.1 Tracker-ball

Connected to the TEC2000 functional keyboard there is a tracker-ball comprising a roller-ball and 3 buttons. The roller-ball moves the cursor on the screen.

Function of left button is: START pump/compressor or open valve.
The middle button, the select button, utilises operation of buttons in the model drawings, retrieval of new sub systems or call display windows.
The push button on the right hand side, is used for execution of commands to STOP pumps/compressors, CLOSE valves or reset of malfunctions introduced.

5.1.2 Keyboard

The keyboard is used to:

- change set point of controllers
- call new model drawings
- change variables in the variable list
- change intensity of malfunctions
- type text strings in connection with creation of scenarios and initial conditions

5.2 Operating panels

The TEC2000 functional keyboard comprises three panels; the Instructor section, the Alarm section and the Operator section. A brief description in utilising these functions are described in the following pages. For further detailed information of the TEC2000 functions, please read the TEC2000 Instructor Manual.

5.2.1 Function buttons at the Instructor section

The functions located at this panel are only accessible when in Instructor mode (all except the RUNNING, FREEZE, STOP and SCENARIO which can be selected from Operator Mode).

5.2.1.1 Instructor/Operator switch selector

Chooses between Operator and Instructor mode. When the key is in Instructor mode, a push on one of the two push buttons next to the key will toggle between Instructor or Operator mode. When in Operator mode input from nearly the whole Instructor section is inhibited. With regard to the Malfunction lists, only the list of malfunctions are visible without any indication of what failure is introduced nor the intensity.

5.2.1.2 Scenario

A scenario is a predefined list of actions and or malfunctions that will take place during the simulation when Running is activated. Almost any action and malfunction available in the simulator can be included in a scenario. The scenario push button, when activated, displays a directory of the scenarios already created. This feature allows the instructor to load an already existing scenario or creating a new one.

To create a scenario, enter scenario by pressing SCENARIO button. Prompts on the screen will guide you through the preparation required. Point and click the software button CREATE at the lower part of the screen, and then point and click at the position where to locate the new scenario (S01 to S20).

After prompt and having typed the name of the scenario, press ENTER. A prompt will then ask for an INITIAL condition which will be the basis for the scenario. Type in the appropriate initial condition (101 to 160) and press enter. If accepted, prompt line will add initial condition name and colour changes.

5.2.1.3 Initial Condition Directory

An Initial Condition is a specific condition of the total simulation plant, comprising a complete set of data and variables. When activating the Init Condition push button, a list of all created initial conditions appears.

To store an initial condition to later use, the following procedure must be carried out. Press Freeze at TEC2000 panel. Choose display INIT CONDITION and click on software button CREATE.
Type in name of the exercise to be saved in one of the vacant locations and press enter. During the process of creating the exercise its name starts flashing. After few seconds, the new initial condition is made, and the simulation can proceed by pressing Running.

To load an Init Condition, press Freeze and click with centre tracker-ball button, on the Init Condition selected. Loading is completed when the name of the exercise turns steady. From this step the simulation can start on condition that Running is pressed.

5.2.1.4 Operating Condition

This function allows the instructor to vary the external parameters, the ship dynamics as well as internal processes. In addition the instructor can introduce fixed values of selected variables.

By pressing this button, an Instructor picture called Operating Condition is displayed. This picture is divided into several groups where the following parameter can be altered.

Access: Different access levels can be set.

Sound Control: Allows the Instructor to control the volume of the Sound System in the Cargo control room where the operational simulator is installed if applicable.

Fixed process: Instructor can introduce fixed process values for some of the major parameters in the systems. Independent of consumption, the fixed values will remain the same. The fixed process is valid for the following systems.

Boiler: Boiler isolation sets the steam pressure to cargo pumps at
15 bar.
Boiler fluegas oxygen content to 3,5 %

Inhibit: The demand for realism with regard to what kind of alarm indication to be most appropriate, depends on the training situation and the number of students present. The functions are disabled when pressed. For the maximum version, the following functions are available.

Alarm Horn (and alarm lamp), operational only.

Keyboard Buzzer (internal in the TEC2000 panel).

Process Dynamics: Changes the simulator time response of the different sub-systems. The faster response, the shorter time is required to establish normal temperatures in tanks, correct viscosity, etc. There are 3 choices:

Normal
Fast
Very Fast

Log printer 1: Determines which events or alarms to be logged on the printer. If required, all buttons can be activated. Press the appropriate push button(s) to satisfy the exercise to be run. The actual event/ alarm is printed together with the time it took place.

The choice is as follows:

Alarm: In general all alarms that occur are printed
Event: All actions from the student are printed, like start/stop of pumps, opening or closing valves
DataChief: All actions from the Electrical Power Plant will be printed. (If connected)
Malfunction: Setting and Resetting of Malfunctions.
Instructor: Not in use

-Log printer 2: For future use.
-Log printer 3: For future use.

Snapshot: A snapshot represents the condition of the simulation at the time it was created. If the student fails to run the simulation properly and for instance this results in a black out or any other abnormal condition, the situation can be corrected by simply retrieve a snapshot prior to the "accident". Each Snapshot is identified by the time it was created, manually or automatically. When generated automatically, the interval between each snapshot has to be specified . See also description of Snapshot push button.

5.2.1.5 Malfunction Editor

Gives ability for editing and creating of malfunctions prior to start or during the simulation.
It is a prerequisite that a scenario is loaded into the workstation .To create a malfunction, click on software button CREATE and click at one of the buttons M01 to M40 and type in a descriptive name of the malfunction.
IMPORTANT: When a malfunction name has been typed and ENTERED, a prompt will ask you which TAG name from the Malfunction List is wanted.

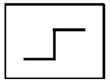
This tag name must be written with full style name and number directly copied from Malfunction List. In addition, type in _S. Otherwise tag will not enter. When prompt changes colour, it will be written ex.. M1301_S, and you are allowed to continue.

In the section VALUE
The active and passive values are entered. When prompted, type in values either digital (0,1,2 etc.) or analogue in percentage of max. value.

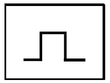
In the section ACTIVE
The value entered is the new default as the fault is activated. Selection of how the malfunction will be introduced; continuos fault or repeating fault in the section “AUTOMATIC MODE”.
In the section PASSIVE
The value entered is starting level at the time when the malfunction is activated.

UNIT
Engineering unit or percentage. Not necessary to be entered.

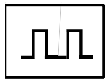
Under column AUTOMATIC MODE:



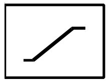
Activating this will make fault go active, and stay active, when entered time is reached.



Activating this button will make fault go active, and then off again when time limits entered are reached.



Activated, this button will make fault go on and off repeatedly within specified time limits, as long as scenario is run.



When activated, time ramp for fault to develop can be specified.

Common for all four function buttons are that faults can be simulated after entering a scenario only when buttons are activated. When active, buttons change colour. Ramp function can be active together with any of three other buttons.

Actions to be created in the same way as malfunction editor. Input of tag names similar to malfunctions editor, adding underscore S after the Malfunction tag.
When starting a scenario, malfunctions and actions which are activated during the simulation, must be chosen by clicking on software buttons. Changing colours will indicate which buttons are activated. In front of each button there is a light with 2 circles.
Outer circle lit means action is activated, but waiting for set time interval to be reached in order to switch action on.

Inner circle lit means that READING is active, meaning set intervals are reached, and action started. On the bottom half of screen (buttons A41 to A80) is event malfunctions. Used and created as malfunction, but triggering actions instead of malfunctions. Such as closing of valves.

5.2.1.6 Sound

Toggles sound system on/off. Valid for operational trainer only.

5.2.1.7 Time Editor

Allows altering the time for which the malfunctions or actions to take place.
Clicking on CHANGE TIMEPHASE software button enters a line on time section of picture. Use the inner scroll buttons to increase or decrease the time between actions or events to take place. Outer scroll buttons to changes time phase.

5.2.1.8 Event Editor

Used to supervise and allows adjusting events and event conditions.

5.2.1.9 Snapshot

Takes a snapshot of simulation for later reference. Places snapshot in snapshot directory is referred to by time.

NOTE! As soon a new Initial Condition is loaded, all snapshots are deleted. However, a snapshot can be stored as an Init Condition (has to be done before loading a new initial condition).

5.2.1.10 Evaluation Editor

For evaluation of the student throughout the exercise taking place. Input of specified measuring variables under tag name. Specify upper and lower limits. Will evaluate how the process is maintained by the student during the simulation. Evaluation criteria is whether student is able to maintain process within specified limits.

5.2.1.11 Running

Starts simulation after having frozen the simulation. The time starts running, and the student(s) can proceed the exercise. When the RUNNING button is pressed, a message will inform that the simulation has started.

5.2.1.12 Freeze

Freezes simulation during breaks or when situation needs time-out for evaluation. When FREEZE button is pushed, a message will inform that simulation is halted. The simulator must be in FREEZE before loading an Initial Condition or a Scenario.

5.2.1.13 Stop

Ends simulation after a message. Pressing STOP and typing "yes" after prompt will log out of simulator completely, and the workstation will return to NORCONTROL login-window.

To restart, proceed according to the following steps:
Type the user's name in the LOGIN picture (i.e. student1) and press ENTER. After a while a new display appears, and by means of the left push button, select the VLCC-II simulation plant. A complete start up takes about 2 - 3 minutes. When finished, the instructor picture Init Condition appears. Load the exercise wanted by pressing the middle button of the tracker-ball at the Init Condition, and proceed by pressing RUNNING.

5.2.2 Alarm Section

5.2.2.1 Alarm Pages

The central alarm system is compressed into the Alarm Section. The alarm system has several push-buttons with a corresponding red alarm indicator numbered from 1 through 28. Normally, all alarm lamps are turned dark. As soon as an alarm occurs, one of the alarm lamps starts flashing. Additional information is obtained by pressing the push button next to the flashing lamp.

Each lamp/push button covers alarm points from dedicated sub systems. The alarm point exceeded normal values, turns into a flashing mode.

The Alarm point (displayed in the MD picture) turns to steady condition as soon as the operator moves the cursor to its location and resets the alarm by using the left hand side push button of the tracker ball.

As appropriate actions are carried out, the alarm point previously indicated alarm condition, turns off.

Measured values are displayed together with tag no., tag name, engineering units, and upper/lower limits for alarms. The limits can be altered from Instructor mode by point and click with centre tracker-ball button at limit and then type in new value, press “Enter” (Carriage Return).

5.2.3 Function buttons at the Operator section

This section comprises all remedies for the student to conduct an exercise independent on the Instructor or other students. From this section, the student has access to the Malfunction List, Variable List, Alarm List, Picture Directory and other useful features. The following pages contain information on how to utilise these functions.

5.2.3.1 Malfunction List

Most of the Model Drawings comprises one or more buttons marked M. By clicking at one of these buttons with the centre push-button of the tracker-ball, a new window will appear at the monitor containing the Malfunction List directory. (The M-buttons turn yellow when malfunctions are activated(in Instructor mode only!)). When in operator mode (student), all malfunctions are displayed, but there is no indication of which fault is introduced. In instructor mode, the same window shows active malfunctions and in addition their settings.
Malfunctions are activated by the left hand side push-button of the tracker-ball, while resetting of malfunctions introduced is carried out by use of the right hand side push-button at the tracker-ball.

To rectify a suspected fault, move the cursor to the variable in the Malfunction List (ex M1301), and press the right hand push-button of the Tracker-ball. The response from the computer will either be "Repair Attempt" or "Malfunction Reset". If the Malfunction log is turned on, all attempts on repairing the fault are printed.

5.2.3.2 Variable List

Displays a window with a list of all variables in the simulator. All related information in organised in groups. This means that all variables from the Cargo line 1 system is located at pages starting at 0010 until 0017. The List can be scrolled, moved or removed by using the select button of the tracker-ball and cursor.
After pushing VARIABLE LIST, identify sub system and press selected system. Displayed window will then be identical to the variables found in the corresponding Model Drawing ex. MD 02 at the monitor. Tag details and measured values will be displayed. Displayed data can be changed after clicking on values with centre tracker-ball button. After typing in new values, and pressing enter new data is entered.

There are several ways to change the value of a model variable (ex. start/stop of pumps). One of them is using the Variable List. (Any pump or valve can be operated from this part of the simulator.) As the component to be operated is found, move the cursor to the corresponding variable, press the select button at the unit and type the new value and terminate by pressing "Enter" (Carriage Return).

5.2.3.3 Alarm List

The Alarm List contains alarm groups displaying information of actual value, alarm limits and alarm status. After recognition of the desired Alarm group in the Alarm group directory, use the select button to display the desired alarm group. List can be scrolled, moved or removed with cursor and centre tracker-ball button to find desired alarm.

After having pressed the ALARM LIST and identified the sub system, window with list of alarms will be displayed.

5.2.3.4 Picture Directory

Displays the directory of all Model Drawings (MD's). After recognition of system, click with the centre tracker-ball push button on the actual Model Drawing, and seconds later, the subsystem is displayed on the screen.

5.2.3.5 Mark Picture

When pressing Mark Picture, the displayed Model drawing can be saved, and easily recalled by using the Recall Marked Picture push-button. After clicking Mark Picture enter a chosen number between 0 and 9. After clicking Recall Marked Picture, followed by the same number, the previously MD is displayed again.

5.2.3.6 Select Picture

Allows selection of a Model Drawing after typing: MD and its corresponding number (in one word). Enter MD and the MD's number without space, i.e. MD 101 and "Enter".

5.2.3.7 Previous Picture:/Next Picture

Allows scrolling to next/previous model drawing (ex.MD 07 MD 08 and MD 09) in line as listed in picture directory.

5.2.3.8 Alarm Acknowledge

Acknowledges the alarm being pointed at with the cursor. Use either the Acknowledge button at the Operator panel or the left tracker-ball button.

5.2.3.9 Alarm Log

Displays pages of all present alarms. To acknowledge all alarms in that specific page, press EXTENDED CHAR button and A simultaneously. Press the "NEXT" or PREV. key at the HP/keyboard to get the next page of alarms.

5.2.3.10 Alarm Silence

Resets alarm horn (where installed) in the Cargo Control Room and the internal buzzer in the TEC2000 keyboard.

5.2.3.11 Print Report

The "Print report" field is on the lower part of the VDU and by pressing this soft button a complete printout of the alarm status is initiated.

5.2.3.12 Unit Conversion

The "Unit Conversion" field is on the lower part of the VDU and by pressing this soft button a menu of different conversions "pops up" (Length, Volume, Area, etc.). Press one of the softkeys in the menu. Press the middle button on the tracker-ball and type the value of the specific unit you want to be converted. And read the converted values in the other fields.

5.3 Cargo Handling Training from the Graphic Workstation

When cargo handling training is done from the graphic workstation the description made for the VLCC-II has to be supplemented by the correct mimic pictures. The following picture directory is then to be used.

5.3.1 Picture directory

101	Cargo Bargraph	128	Wing Tank 4 Port Condition	222	Center Tank 1 Atmosphere
102	Cargo Survey	129	Wing Tank 5 Port Condition	223	Center Tank 2 Atmosphere
103	Shear Force	130	Wing Tank 6 Port Condition	224	Center Tank 3 Atmosphere
104	Bending Moment	131	Wing Tank 1 Stb. Condition	225	Center Tank 4 Atmosphere
105	Deflection	132	Wing Tank 2 Stb. Condition	226	Wing Tank 1 Port Atmosphere
106	Stability Curve	133	Wing Tank 4 Stb. Condition	227	Wing Tank 2 Port Atmosphere
107	Load/Discharge	134	Wing Tank 5 Stb. Condition	228	Wing Tank 4 Port Atmosphere
108	Cargo Deck Line	135	Wing Tank 6 Stb. Condition	229	Wing Tank 5 Port Atmosphere
109	Cargo Pump Room	201	Bunkers and Water Bargraphs	230	Wing Tank 6 Port Atmosphere
110	Cargo Bottom Lines	206	Load Discharge Ballast Routing	231	Wing Tank 1 Stb. Atmosphere
111	Line 1	207	Monitor	232	Wing Tank 2 Stb. Atmosphere
112	Line 2	208	Boiler	233	Wing Tank 4 Stb. Atmosphere
113	Line 3	209	Inert Gas Plant	234	Wing Tank 5 Stb. Atmosphere
114	Line 4	210	Inert Gas Distribution	235	Wing Tank 6 Stb. Atmosphere
115	Ballast Line	211	Crude Oil Pump 1/separator		
116	Slop Tanks/Oil Discharge Monitor	212	Crude Oil Pump 2/separator	240	Cargo Pumping Diagram
122	Center Tank 1 Condition	213	Crude Oil Pump 3/separator		
123	Center Tank 2 Condition	214	Crude Oil Pump 4/separator		
124	Center Tank 3 Condition	215	Ballast Water Pump	300	Description of Legend
125	Center Tank 4 Condition	216	Stripping Pump/Eductor/Cow/Sw	301	Pen Recorder
126	Wing Tank 1 Port Condition				
127	Wing Tank 2 Port Condition			500	Directory 2 LOAD MASTER

5.3.2 Picture Directory 2 LOAD MASTER

The following mimic pictures from the Load Master are available. The operational description follows hereafter.

501	Cargo Bargraph (Load Master)				
502	Cargo Survey (Load Master)				
503	Shear Force (Load Master)				
504	Bending Moment (Load Master)				
505	Deflection (Load Master)				
506	Stability Curve (Load Master)				
		601	Misc. Tanks (Load Master)		
				100	Directory 1

Off - line cargo calculation is entered through picture directory 2, Load Master. A complete precalculation of trim, stability and stress is conducted by entering the volume or Mass in each tank from the cargo bargraph picture. By using the short cut button the variable page will pop up. From the variable page one can chose the following conditions for update:

- Update Loadmaster from actual situation, I.E. partly loaded.
- Update Loadmaster with fully loaded ship.
- Update Loadmaster with empty ship.
- Update Simulator with Loadmaster condition.
- Repeat functions for updating all tanks with equal parameters

5.3.3 General Operation

How to change parameters and their influence on draft, trim ,heel ,tank levels, flow and the operation of pumps and valves are described in the following sections.

5.3.3.1 Draft

The amidships draught is changed by changing the displacement. The fore and aft drafts are changed by changing the displacement and/or the trim.

Note: This change will cause another load distribution, resulting in another distribution of shear forces, bending moments and hull deflection.

5.3.3.2 Trim

The trim is changed by changing the load moments of the fore and aft halves of the ship.

Note: This change will cause another load distribution which results in another distributing of shear forces, bending moments and hull deflection.

5.3.3.3 Heel (list)

The heel (list) is changed by changing the load moments in the wing tanks.

00:00:00 Freeze	Picture MD 101	**Cargo Bargraph**	Alarm Group

NOR CONTROL

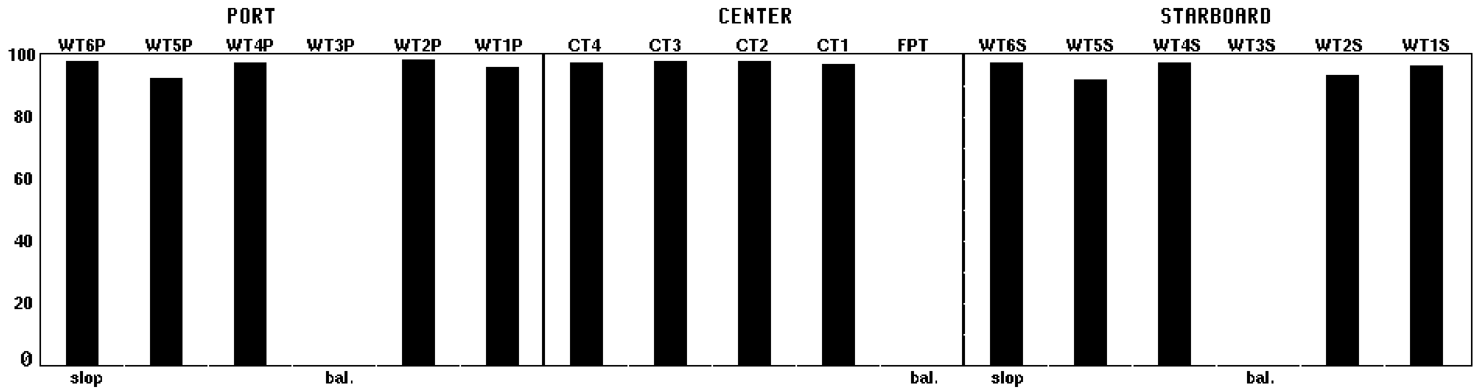
CONDITION
Sea Density D 1025.0
Sea temp T 25.00 C

DISPLACEMENT
1000 ton M 210.35

DEADWEIGHT
1000 ton M 180.79
% of summer mark V 96.17

DRAUGHT (meter)
Aft L 18.51
Mid./STBD L 18.30
Mid./PORT L 18.30
Fwd L 18.09
Trim L 0.43
Heel L 0.00

STABILITY (meter)
GM Corr. L 5.50
FS Red. L 0.72
DS Rad E 14.91



	WT6P	WT5P	WT4P	WT3P	WT2P	WT1P	CT4	CT3	CT2	CT1	FPT	WT6S	WT5S	WT4S	WT3S	WT2S	WT1S
% full	V98.26	V92.92	V97.92	V0.02	V98.70	V96.04	V97.99	V98.08	V98.01	V97.07	V0.00	V98.00	V92.46	V97.59	V0.02	V93.99	V96.54
Density kg/m³	D820.00	D819.98	D820.00	D1025.0	D819.99	D819.99	D819.99	D819.99	D819.99	D819.99	D1025.0	D820.00	D819.98	D820.00	D1025.0	D819.99	D819.99
Flow out m³/h	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00	G0.00
Quantity	M3185.5	M6570.0	M11401.	M1.00	M7354.0	M9674.7	M24207.	M24239.	M24223.	M23983.	M0.00	M3177.2	M6537.3	M11364.	M1.00	M7003.5	M9724.6

Port: **M 38.19** ktonnes   Center: **M 96.65** ktonnes   Starboard: **M 37.81** ktonnes

201 To Bunkers and Water Bargraphs   Total: **M 172.65** ktonnes

CHT2000-VLCC-II REV: 1.3

5.3.3.4 Tank levels

Tanks levels are changed dynamically by changing the volumes of liquid in the tanks.

The volume of liquid in the tanks is changed by generating flows to or from the tanks.

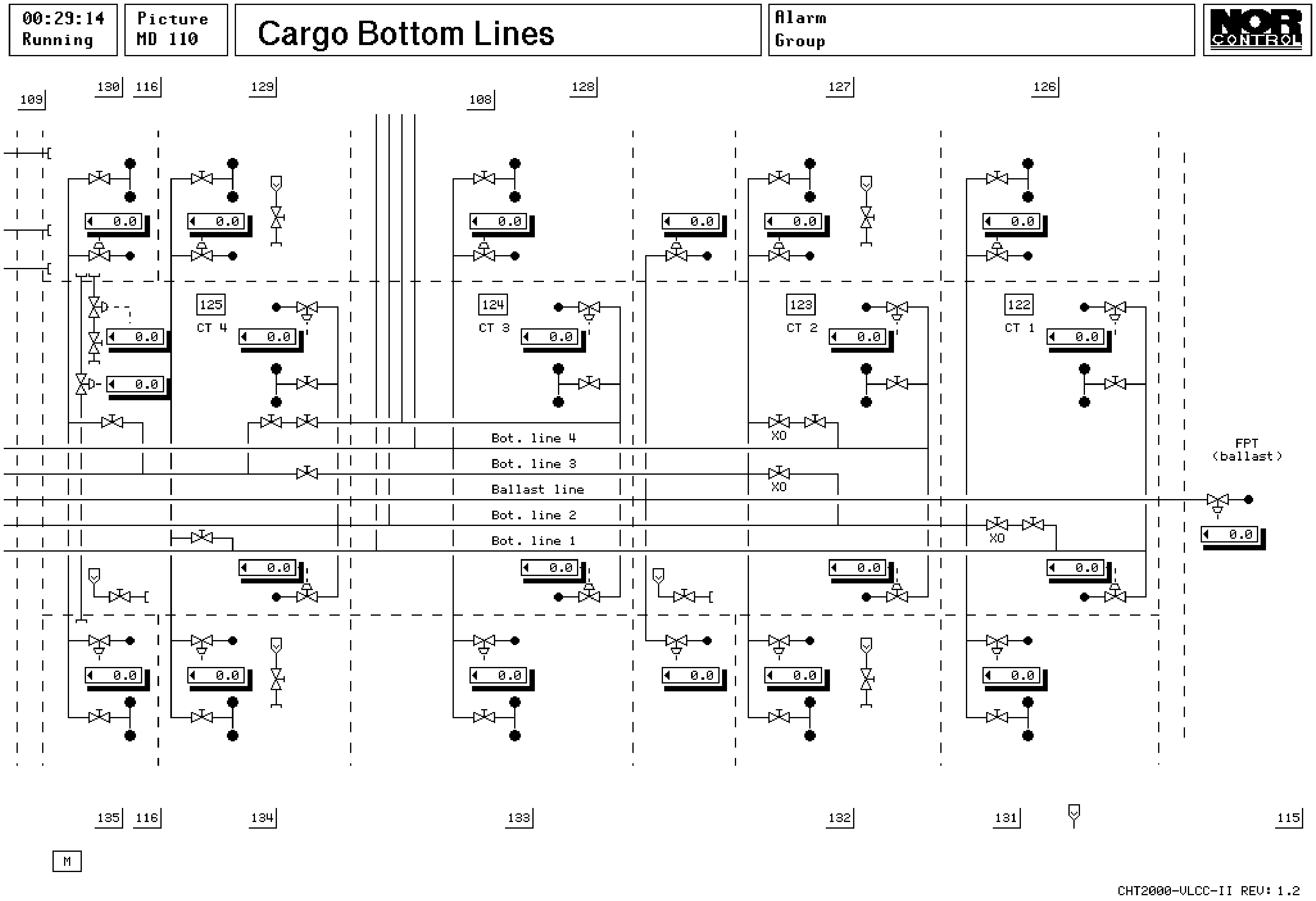
Flows can be generated in two ways:

- Gravity flow
- Pump flow

5.3.3.5 Gravity Flow

The gravity flow is generated by opening the valves between two or more tanks with different liquid levels, opening of manifolds when connected and by opening seachest in the ballast system. A flow will then start from the tank with the higher level to the tank with lower level and for ballast according to draught. The flow rate will depend on:

- The difference between the actual tank levels.
- The flow resistance caused by pipe characteristics. Valve characteristics and valve setting.
- The flow will continue as long as a difference in tank levels is present. The tank levels will change according to the flow rate and the tank discharging valve(s).
- When ballasting the flow will continue until the draught and the level in the ballast tanks equalise.


00:29:14
Running
Picture
MD 110
Cargo Bottom Lines
Alarm
Group
NOR CONTROL
109
130
116
129
108
128
127
126
125
CT 4
124
CT 3
123
CT 2
122
CT 1
Bot. line 4
Bot. line 3
Ballast line
Bot. line 2
Bot. line 1
XO
FPT
(ballast)
135
116
134
133
132
131
115
M
CHT2000-VLCC-II REV: 1.2

5.3.3.6 Pump Flow

The pump flow is generated by opening the suction valve(s), starting the pump and opening the discharge valve(s).

The flow rate will depend on:

- The pump speed.
- The flow resistance caused by pipe characteristics.
- Valve characteristics and valve settings.
- The suction head (cavitation).
- The liquid density.

5.3.3.7 Cargo/Ballast Valves and Pumps

The cargo/ballast valves are operated mainly from the cargo line and pump mimics.

5.3.3.8 Pump, Tank and Valve overview

The cargo/ballast valve configuration, is shown in the Load/Discharge/Ballast routing **picture MD 206** and deck, bottom line pictures.

This picture is not dynamic.

5.3.3.9 Bottom Valves

The bottom valves are on/off valves and throttle valves. They are operated from the cargo bottom lines **picture MD 110**

5.3.3.10 On/off Valves

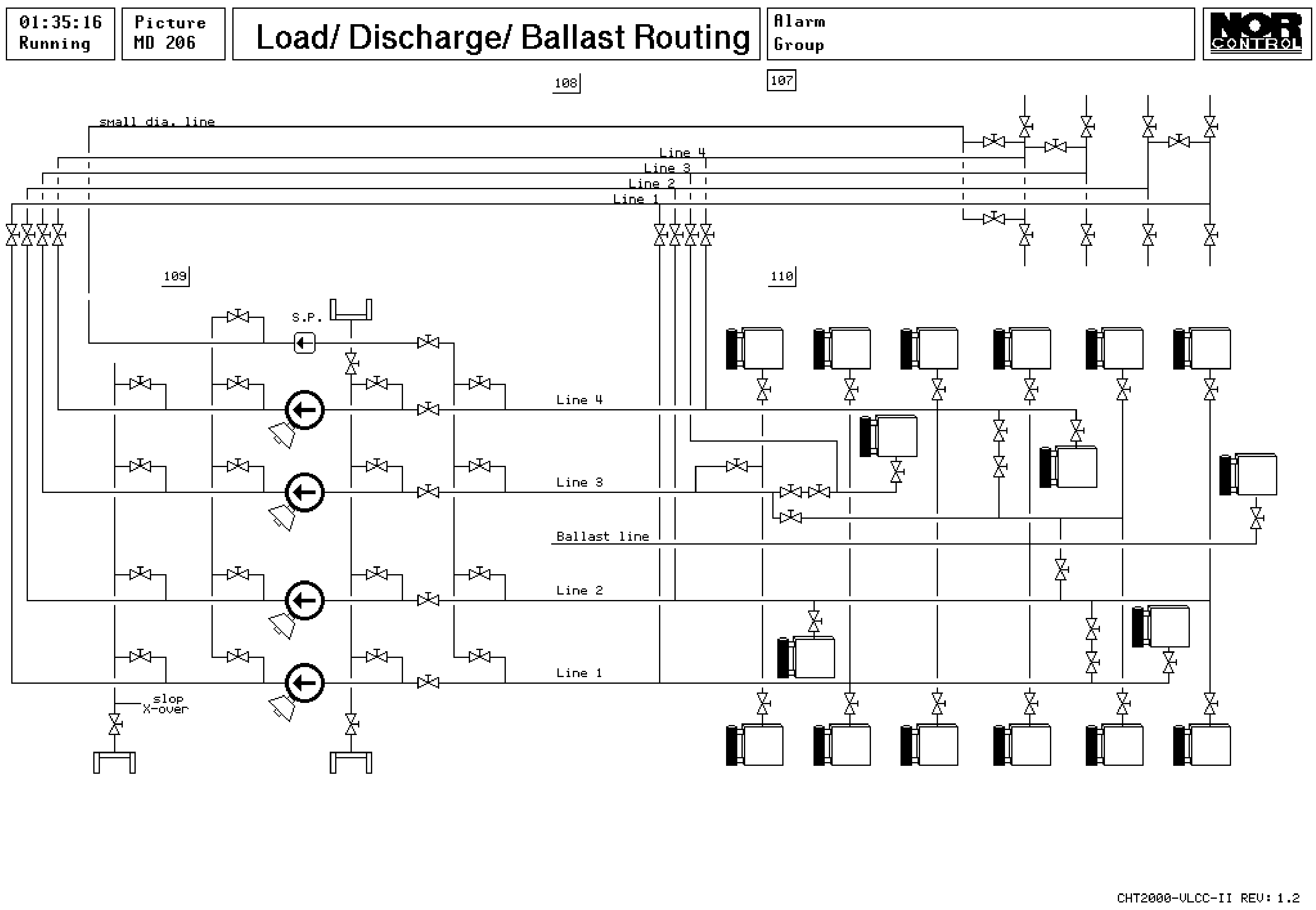
The on/off bottom valves are used during normal loading/discharging. The valves are operated by means of the OPEN and CLOSE clicking on the valve symbol.

5.3.3.11 Throttle Valves

The throttle bottom valves can be used to achieve a more accurate control of the flow during the last stage of loading (topping-up). These valves are positioned closer to the bulkheads and closer to the bottom than the on/off valves. The throttling bottom valves are operated by the SELECT clicking on the symbol. The current valve position can be read on an indicating meter and changed by entering a new value between 0-100% followed by ENTER.

5.3.3.12 Cross-over Valves

The cross-over valves in the pump room are modelled as on/off valves and are operated by an OPEN and CLOSE clicking on the symbol.


01:35:16
Running
Picture
MD 206
Load/ Discharge/ Ballast Routing
Alarm
Group
NOR CONTROL
108
107
small dia. line
Line 4
Line 3
Line 2
Line 1
109
110
S.P.
Line 4
Line 3
Ballast line
Line 2
Line 1
slop
X-over
CHT2000-VLCC-II REV: 1.2

5.3.3.13 **Deck Valves**

The deck valves are modelled as on/off valves and are operated by an OPEN and CLOSE clicking on the symbol. The manifold shore connection can only be connected from the Instructor mode. (**picture MD 107-108, and 111 - 114**).

5.3.3.14 **Cargo pumps and discharge valves**

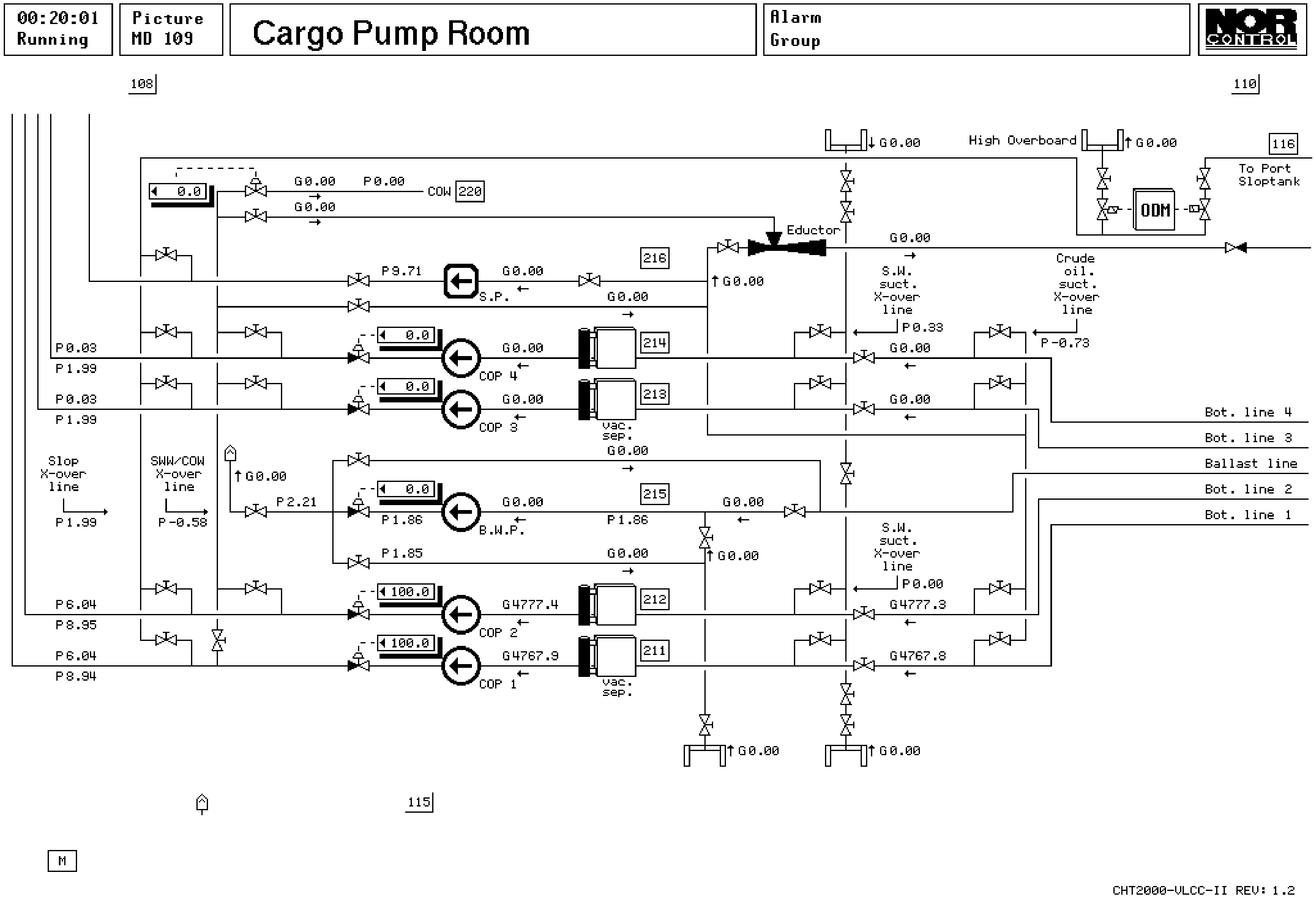
The cargo pumps and ballast pump are of the centrifugal type pumps. All pumps are operated from the Individual pump (**picture MD 211-215**).

Trip

The pumps may trip if one or more of the following conditions are present:

- Steam supply pressure is too low.
- Condenser pressure is high.
- Inert Gas pressure is low (cargo pumps, only).
- Bearing lub. oil pressure to low
- Bearing lub oil temp. to high

These conditions can be set by the engineer (i.e. the instructor), or arise by incorrect operation


00:20:01
Running
Picture
MD 109
Cargo Pump Room
Alarm
Group
NOR CONTROL
108
110
116
High Overboard
To Port
Sloptank
ODM
Eductor
COW 220
216
214
213
215
212
211
S.P.
COP 4
COP 3
B.W.P.
COP 2
COP 1
vac.
sep.
S.W.
suct.
X-over
line
Crude
oil.
suct.
X-over
line
Slop
X-over
line
SWW/COW
X-over
line
Bot. line 4
Bot. line 3
Ballast line
Bot. line 2
Bot. line 1
115
M
CHT2000-VLCC-II REV: 1.2

Starting Procedure

The pump is started by clicking the start symbol.

The following is the normal starting procedure for centrifugal type pumps:

- Close the discharging valve.
- Open the suction valve.
- Fill the pump with liquid (oil/water).
- Start the pump.
- Open the discharging valve.

Increase/Decrease

The set-point of the pump turbine governor, which regulates the pump speed, is controlled by the Speed surge controller by selecting the speed control button and enter a new RPM value.

Open/Close

The discharge valve setting is controlled by means of the Valve control button. Select valve position by clicking in the window in the control button and enter an opening value (0 - 100%)

The pump flow and the pump pressure are controlled by the pump speed setting and the discharge valve setting.

High bearing temperature

Running the pump at substantial speed against high discharge pressure may cause a high bearing temperature after a period of time, even if the discharge valve is equipped with a recirculating release valve.

The performance of the pump turbine is dependent on the steam supply pressure and temperature, as well as the condenser vacuum. These parameters will vary with the pump turbine load.

Cavitation

If the suction head is too low, the pump will start cavitating. The critical suction head for cavitation will depend on the vaporising pressure of the liquid to be pumped and the current NPSH (Net Positive Suction Head) of the pump. Cavitation will occur on the cargo pumps, but is not modelled on the ballast pump.

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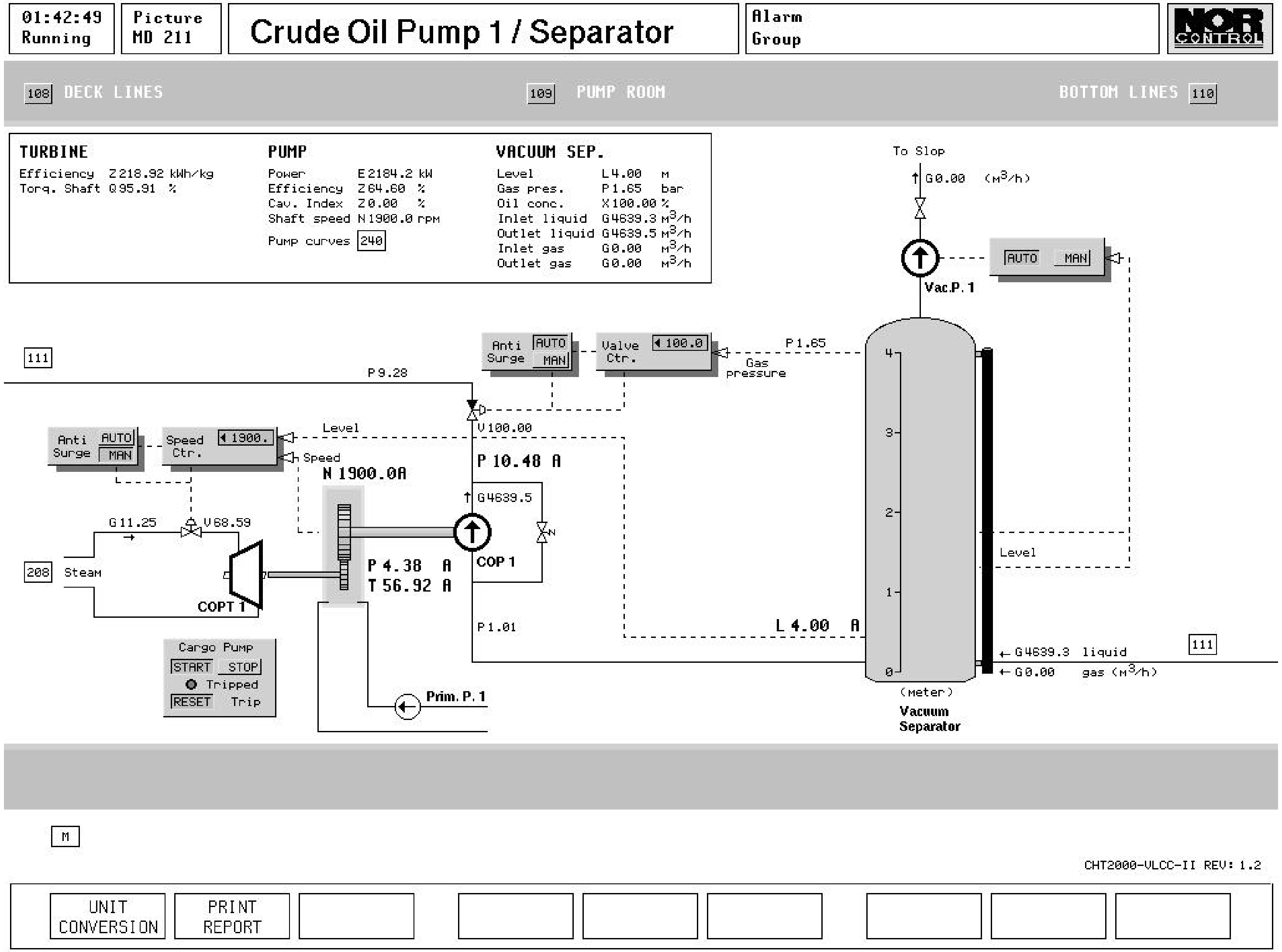

01:42:49
Running
Picture
MD 211
Crude Oil Pump 1 / Separator
Alarm
Group
108 DECK LINES
109 PUMP ROOM
BOTTOM LINES 110
TURBINE
Efficiency Z 218.92 kWh/kg
Torq. Shaft Q 95.91 %
PUMP
Power E 2184.2 kW
Efficiency Z 64.60 %
Cav. Index Z 0.00 %
Shaft speed N 1900.0 rpm
Pump curves 240
VACUUM SEP.
Level L 4.00 m
Gas pres. P 1.65 bar
Oil conc. X 100.00 %
Inlet liquid G 4639.3 m3/h
Outlet liquid G 4639.5 m3/h
Inlet gas G 0.00 m3/h
Outlet gas G 0.00 m3/h
To Slop
G 0.00 (m3/h)
AUTO MAN
Vac.P. 1
111
P 9.28
Anti Surge AUTO MAN
Valve Ctr. 100.0
P 1.65
Gas pressure
Anti Surge AUTO MAN
Speed Ctr. 1900.
Level
Speed
V 100.00
N 1900.0A
P 10.48 A
G 4639.5
G 11.25
V 68.59
208
Steam
COPT 1
P 4.38 A
T 56.92 A
COP 1
P 1.01
L 4.00 A
Level
Cargo Pump
START STOP
Tripped
RESET Trip
Prim. P. 1
111
G 4639.3 liquid
G 0.00 gas (m3/h)
(meter)
Vacuum Separator
M
CHT2000-VLCC-II REV: 1.2
UNIT CONVERSION
PRINT REPORT

5.3.3.15 Oil/Gas Separator with Vacuum Pump

The cargo pumps are furnished with oil/gas separators with vacuum pumps. The vacuum pumps are started automatically at low liquid level in the separator. The state of the vacuum pump is shown by a running light (Pump symbol changes colour from black to Grey). If the liquid level in the oil/gas separator becomes too low, gas or air will enter into the pump and cause cavitation, lost pumping capability and pump overspeed.

These problems can occur if the vacuum pump does not start automatically at low level. (The result can be demonstrated by setting the vacuum pump in manual under low liquid level).

For training purposes the pump speed and the discharge valve opening can be controlled separately from each other. However, modern cargo control techniques for prevention of cavitation and overspeed, including "Speed Surge Control" and "Flow Surge Control" are available.

Speed Surge Control

The Speed Surge Control can be handled by means of clicking the AUTO or MANUAL selection. In this way, the pump speed setpoint is limited automatically by the liquid level. If the level is reduced, the pump speed set-point is reduced accordingly over-riding the manual speed setting.

By clicking on the speed control section button, a pop-up window with a pen recorder can be viewed. This will give information about the operation performance of the controller.

Flow Surge Control

The Flow Surge Control mode can be handled by means of clicking the section. In this way the discharge valve opening is limited automatically by the pump suction pressure drop, the discharge valve opening is reduced accordingly, and will override the manual speed setting.

The speed Surge Control and the Flow Surge Control can be set simultaneously.

Tripping

If critical conditions occur, the pump will be tripped, i.e.: the pump turbine steam supply valve will automatically close. The pump will consequently lose power and eventually stop.

Reset trip

The pump trip is indicated by a flashing light on the pump control section. Before the pump can be re-started the trip must be reset. Re-setting is achieved by clicking the RESET symbol after the pump has stopped. The flashing light in the TRIP lamp will be extinguished if the cause for the trip has disappeared, or turn to steady on light if the cause for the trip is still present. This condition can be reset by the engineer (i.e. the instructor).

Trip Causes

The cause for the trip can be printed out on the instructor's printer and can also be identified on the display and on the instructor's VDU. The trip causes are:

- Overspeed.
- Lub. oil pressure low.
- Bearing temperature high.
- Discharge pressure high.
- Inert Gas pressure are "low-low" (cargo pumps only).

The pump is stopped by clicking the symbol on the pump control section. The turbine steam supply valve is closed and the pump is brought to stop after a while.

5.4 Loading Procedure

5.4.1 Voyage Orders

These instructions will be sent to the vessel by Charterers or Owners and will contain the following information:

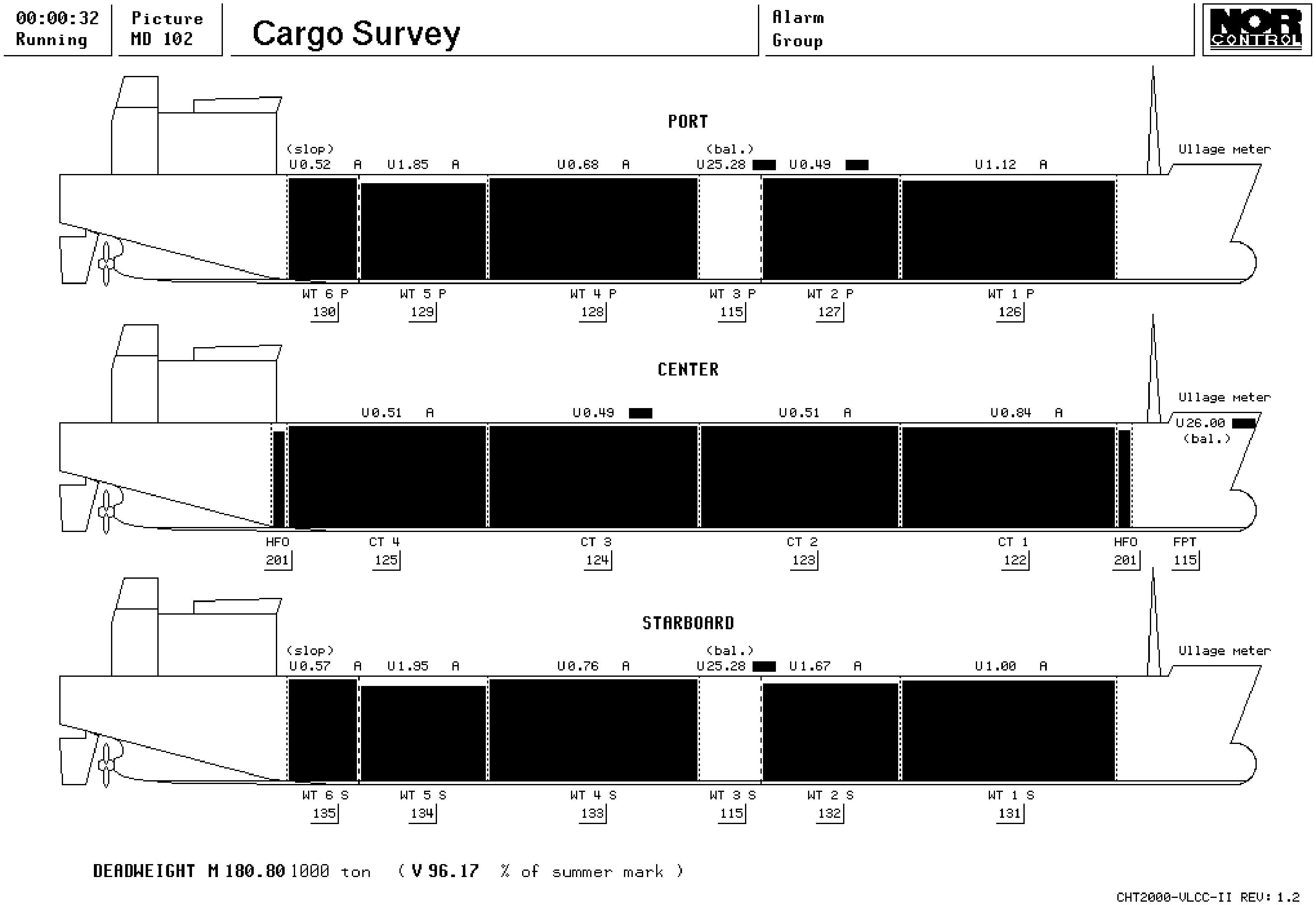
- Port(s) of loading and discharging.
- Volume, grade(s) and API.
- Special requirements of the cargo, i.e. heating.
- Special properties of the cargo, i.e. H_2S.
- Limitation of draft at discharge port.
- Stemming details.

The vessel is responsible for loading under these orders. The maximum amount of cargo to be loaded is dependant on the load line limitation, filling ratio requirements or any particular requirement stipulated in the voyage orders.

5.4.2 Planning Cargo Stowage

In planning the stowage of the cargo the following considerations should be taken into account:

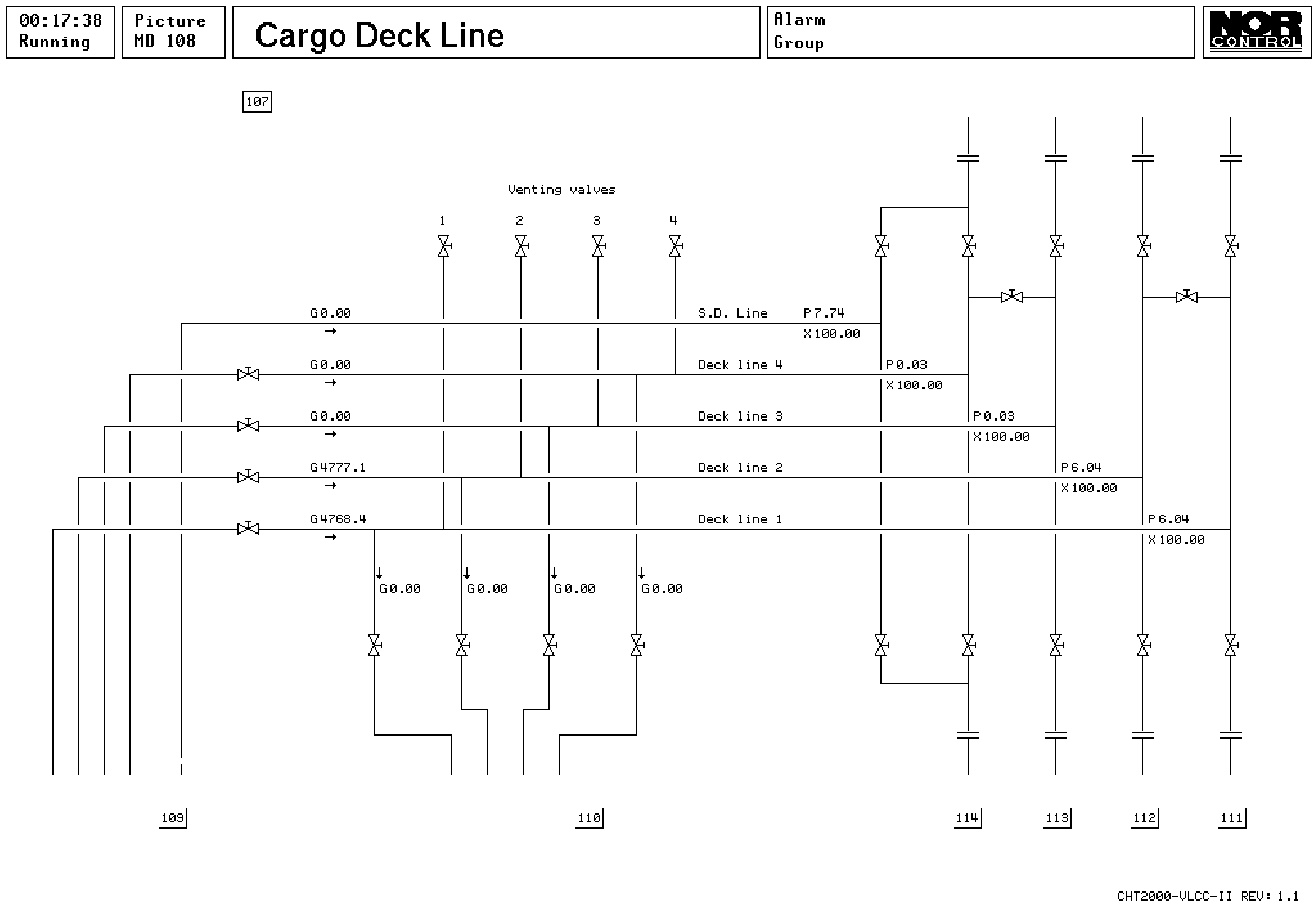
- The limiting zone of the laden voyage is to be determined by zone charts, encountered and estimated fuel consumption on planned passage.
- The final freeboard should be in compliance with the applicable load line zone with allowance for; voyage consumption of bunker, the F.W. allowance and deflection.
- The sailing condition should be within the maximum permissible limits of bending and shear force moments for sea condition.
- If the proposed voyage is to or through warmer areas, sufficient volume should be left in the tanks to allow for possible expansion of cargo.
- There should be two valves between segregated cargo parcels.
- The sailing trim should ensure that the vessel arrives at the discharge port on even keel draft.
- Tanks should be allocated to different grades to enable the vessel to trim sufficiently for efficient discharge and draining of tanks, and efficient scheduling of discharge, COW and stripping.
- One tank should be designated the last tank of loading. This is usually a centre tank at the trimming centre of the vessel.


00:00:32
Running
Picture
MD 102
Cargo Survey
Alarm
Group
NOR CONTROL
PORT
(slop)
U0.52 A
U1.85 A
U0.68 A
(bal.)
U25.28
U0.49
U1.12 A
Ullage meter
WT 6 P
130
WT 5 P
129
WT 4 P
128
WT 3 P
115
WT 2 P
127
WT 1 P
126
CENTER
U0.51 A
U0.49
U0.51 A
U0.84 A
Ullage meter
U26.00
(bal.)
HFO
201
CT 4
125
CT 3
124
CT 2
123
CT 1
122
HFO
201
FPT
115
STARBOARD
(slop)
U0.57 A
U1.95 A
U0.76 A
(bal.)
U25.28
U1.67 A
U1.00 A
Ullage meter
WT 6 S
135
WT 5 S
134
WT 4 S
133
WT 3 S
115
WT 2 S
132
WT 1 S
131
DEADWEIGHT M 180.80 1000 ton (V 96.17 % of summer mark)
CHT2000-VLCC-II REV: 1.2

5.4.3 The Loading Plan

The loading plan should show the following details:

- Names and quantities of the products to be loaded.
- Cargo breakdown.
- The pipeline system to be used for each grade.
- The sequence in which products are to be loaded and discharged.
- The final ullage.
- Forward, amidships and aft sailing draft.
- Identification of all cross-over and sea valves to be closed and/or sealed.
- Required loading rate.



00:17:38
Running
Picture
MD 108
Cargo Deck Line
Alarm
Group
107
Venting valves
1
2
3
4
G0.00
S.D. Line
P7.74
X100.00
G0.00
Deck line 4
P0.03
X100.00
G0.00
Deck line 3
P0.03
X100.00
G4777.1
Deck line 2
P6.04
X100.00
G4768.4
Deck line 1
P6.04
X100.00
G0.00
G0.00
G0.00
G0.00
109
110
114
113
112
111
CHT2000-VLCC-II REV: 1.1

5.4.4 Deballasting

Unless otherwise specified, the vessel should arrive load port with clean ballast and decanted slops, in accordance with LOT procedures(Load on Top procedures).
Unless Terminal, local or international regulations require otherwise, the vessel should deballast at sea, prior to loading.

Simultaneous deballasting and loading of cargo tanks should not be attempted unless there is at least a two valve separation and the valves have been tested and found tight.

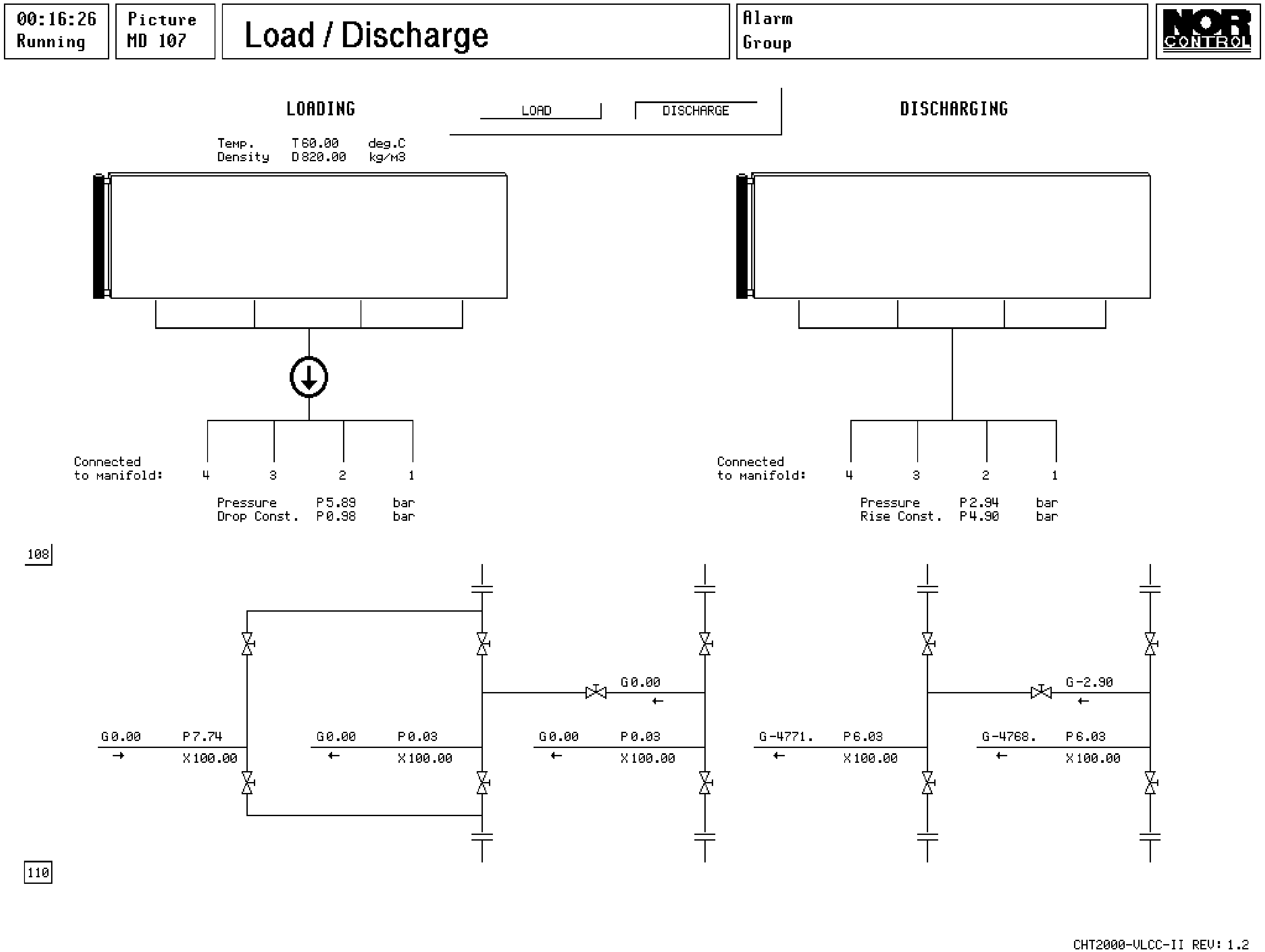
If the segregated ballast is sufficient to maintain the draft and freeboard limits required, part cargo may be loaded prior to deballasting i.e. load, deballast, load.

During deballasting all possible clean ballast should be drained from the cargo tanks. At the end of deballasting, cargo lines should be drained into an after most cargo tank and stripped using the piston stripping pump. If ballast is discharged to a shore reception facility, then final discharge of ballast stripping must be performed using the Small Diameter Line.

5.4.5 Lining up Pipelines and Valves

Prior to loading, deck and pump room lines should be clearly arranged. Cargo should flow through loading drop lines/valves and bypass the pump room.

Pump room cargo-line valves and sea suction valves should be firmly shut . Deck valves which will not be used should be checked to ensure they are shut. The position of all main-valves, stripping and tank valves must be checked to ensure that those valves which should be closed actually are closed.



00:16:26
Running
Picture
MD 107
Load / Discharge
Alarm
Group
LOADING
LOAD
DISCHARGE
DISCHARGING
Temp. T 60.00 deg.C
Density D 820.00 kg/m3
Connected
to manifold: 4 3 2 1
Pressure P 5.89 bar
Drop Const. P 0.98 bar
Connected
to manifold: 4 3 2 1
Pressure P 2.94 bar
Rise Const. P 4.90 bar
108
G 0.00
G -2.90
G 0.00 P 7.74
X 100.00
G 0.00 P 0.03
X 100.00
G 0.00 P 0.03
X 100.00
G -4771. P 6.03
X 100.00
G -4768. P 6.03
X 100.00
110
CHT2000-VLCC-II REV: 1.2

5.4.6 Setting P/V-valves

The vessel should use closed loading, which means loading with closed ullage, sounding and sighting ports, except for initial and final inspection. Vapour displaced by incoming cargo should be vented via the P/V valves, which will ensure that vapour are taken clear of the cargo deck.

Ensure that the Inert Gas-plant is shut down, the deck isolating valve is shut and that the main Inert Gas venting valves are open.

5.4.7 Manifold Valve(s)

The manifold valve(s) shall remain shut until the vessel is completely ready to load and not opened until confirmed from the Terminal.

5.4.8 Commencement of Loading

When all necessary valves in the loading system are checked open, and the vessel has signified its readiness, loading can commence. The loading operation shall commence at reduced rate. The line-up should then be checked by:

- Ensuring that the cargo is flowing into correct tank(s).
- Ensuring that cargo is not flowing into incorrect tanks.
- Ensuring that there is no leaks in the valve or piping.

After these checks have been made, and found satisfactory, the vessel may inform the Terminal to increase the flow to agreed full loading rate.

5.4.9 Monitoring Cargo Tanks

The ullage of the tanks being loaded should be frequently and regularly monitored, especially when approaching the topping off range.

Cargo temperature should be taken both at beginning and end of loading.

5.4.10 Changing Tanks

Extra care should be exercised to avoid over pressuring the ships- and shore lines by closing too many valves against the shore pressure.

When topping off, special care should be exercised and the rate of flow reduced to the actual tank. The following points should be considered when topping off tanks:

- Closing off one tank increases the rate of flow to other open tanks on the same line. As the vessel trims by stern, the rate of flow into open aft tanks will increase.

- The rate of flow into any tank which is nearly full can quickly be reduced by opening the valve to an empty tank on the same line. This procedure, in conjunction with closing the valve on the full tank, permits precise control of the rate of loading of individual tanks.

- The liquid level in topped off tanks should be checked frequently to make certain that the level is not rising because the tank valve is leaking or is not properly closed.

5.4.11 Final Tank

The vessel should request the topping off rate before each tank reaches the pre-determined ullage. When ordering loading to stop, time should be allowed for the terminal to shut down. Space should be allowed in the tank for this, and also for draining loading arms.

5.4.12 Checks after Loading

As soon as loading is completed and the loading arms have been drained and disconnected, the officer on duty (student) should ensure that all valves in the cargo system and appropriate tank openings are closed.

5.4.13 Laden Voyage

During the laden voyage a positive Inert Gas pressure of at least 0.1 Bar should be maintained in the cargo tanks. Topping up Inert Gas pressure during the voyage may be necessary. When topping up the Inert Gas pressure in the cargo tanks, particular attention should be paid to the O_2content. The O_2 content should be less than 5 % by volume before the Inert Gas is introduced into the cargo tanks.

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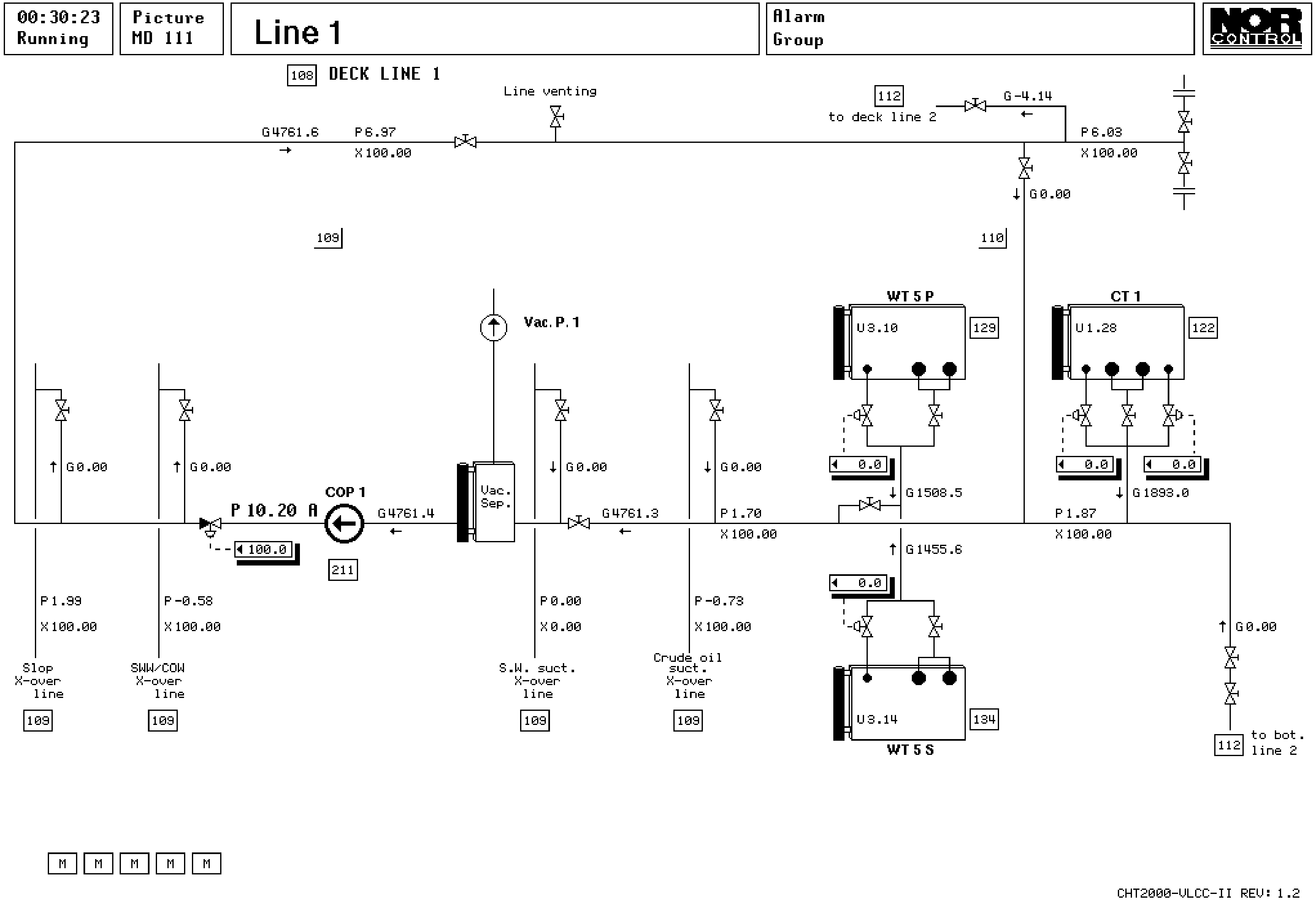


00:30:23
Running
Picture
MD 111
Line 1
Alarm
Group
108 DECK LINE 1
Line venting
G4761.6
P 6.97
X 100.00
112
to deck line 2
G -4.14
P 6.03
X 100.00
G 0.00
109
110
WT 5 P
U 3.10
129
CT 1
U 1.28
122
Vac. P. 1
G 0.00
G 0.00
G 0.00
G 0.00
0.0
0.0
0.0
G 1508.5
G 1893.0
COP 1
P 10.20 A
G4761.4
Vac. Sep.
G4761.3
P 1.70
X 100.00
P 1.87
X 100.00
100.0
211
G 1455.6
0.0
P 1.99
X 100.00
P -0.58
X 100.00
P 0.00
X 0.00
P -0.73
X 100.00
G 0.00
Slop X-over line
SWW/COW X-over line
S.W. suct. X-over line
Crude oil suct. X-over line
109
109
109
109
U 3.14
134
WT 5 S
112
to bot. line 2
M M M M M
CHT2000-VLCC-II REV: 1.2

5.5 Discharging Procedure

5.5.1 Operational Objectives

Your Cargo Loss Control Program must aim at both maximising cargo outturn and closely monitoring cargo measurement. Accordingly, the objective of every discharge is to outturn the maximum quantity of cargo and to operate the highest safety and anti-pollution standards.

5.5.2 Discharging sequence

The discharge sequence should be performed in such a way that the vessel has good draining trim i.e. 5 - 6 meters in the initial stage of discharge. Adequate draining trim will allow early effective stripping, and leave minimal quantities in the tanks for final stripping.

5.5.3 Limiting Factors

Draft

Discharging Terminals usually have limited depth of water at the berth which may prevent the vessel from achieving a good draining trim until late in the discharging operation.

Berth Time
Some terminals limit berth time. In order to fully outturn cargo it may be necessary to reduce ballasting time by taking on reduced ballast alongside and ballasting in river passage, or ballasting during discharge.

Ballasting during discharge can take place only when the tanks to be ballasted have been fully stripped of cargo, and the vessel has an efficient two valve separation. There must be at least a two valve separation on the main pump room suction line between cargo and sea valves.

High Back Pressure
Ballasting during discharge will increase the pumping time and will also make stripping difficult. The discharge is to be sequenced so that minimum quantities remain in slop tanks for stripping. During stripping the pumps may be lined up in sequence.

Stress

Vessel must not exceed maximum calm water stress limits (harbour condition) at any time during cargo operations.

The vessel may also have operating constraints such as:

- Leaking pipelines.
- Faulty valves.
- Inoperative pumps.
- Dirty sea chests
- Faulty inertgas plant

These difficulties may be overcome during the discharge operation by a careful planned operation which compensates for them.

5.5.4 Discharge Plans

These plans are to be prepared prior to vessel's arrival and should include instructions on:

- Discharge pumps and line to be used, and discharging sequence, and any special operational procedures.

- Ballasting after discharge.

- Method of how to stop cargo pumps and to raise alarm in case of fire or pollution. Copy of the discharge plan should be given to Terminal representative.

5.5.5 Cargo Loss Control

During discharge the following measures are to be taken:

- All cargo tanks are to be stripped using the most effective method. Every effort is to be made to pump ashore the maximum amount of cargo.

- Final stripping of all tanks is to be carried out when all main cargo tanks have been discharged. The cargo tanks are to be systematically drained from forward to aft into the port slop tank.

- After this process, the slop tank is to be discharged by main cargo pump to the lowest possible level in the tank.

- The remaining cargo is to be stripped ashore. Main cargo lines are to be drained into the slop tank before final stripping is performed.

- Final stripping to be carried out by using the piston stripping pump and discharged ashore through the Small Diameter Line.

5.5.6 Instructions during and after Discharge

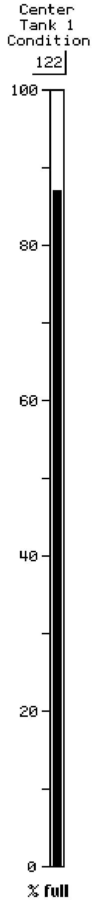
It is of major importance that maximum diligence is used by the vessel (student) during the final discharging to avoid damage or pollution claims:

- Make sure that vessel is trimmed to maximum allowable trim (stern) during the final stripping of all cargo tanks.

- Always carry out 100 % COW of all cargo tanks (if permission granted by receivers or instructed by Charterers). This procedure allows free flow of liquid cargo to the suction bell mouths, and also prevent blockage through build up of sediment/sludge.

- If dirty ballast is filled prior to departure/completion of discharge, the Student must make sure that the tanks where dirty ballast is filled are stripped and completely dry. All cargo lines and cargo pumps containing cargo are to be stripped/drained completely dry before filling ballast.

01:53:52 Running	Picture MD 222	**Center Tank 1 Atmosphere**	Alarm Group



GAS FLOW

Inert inlet	G	1462.0	m^3/h

INERT GAS DECK LINE

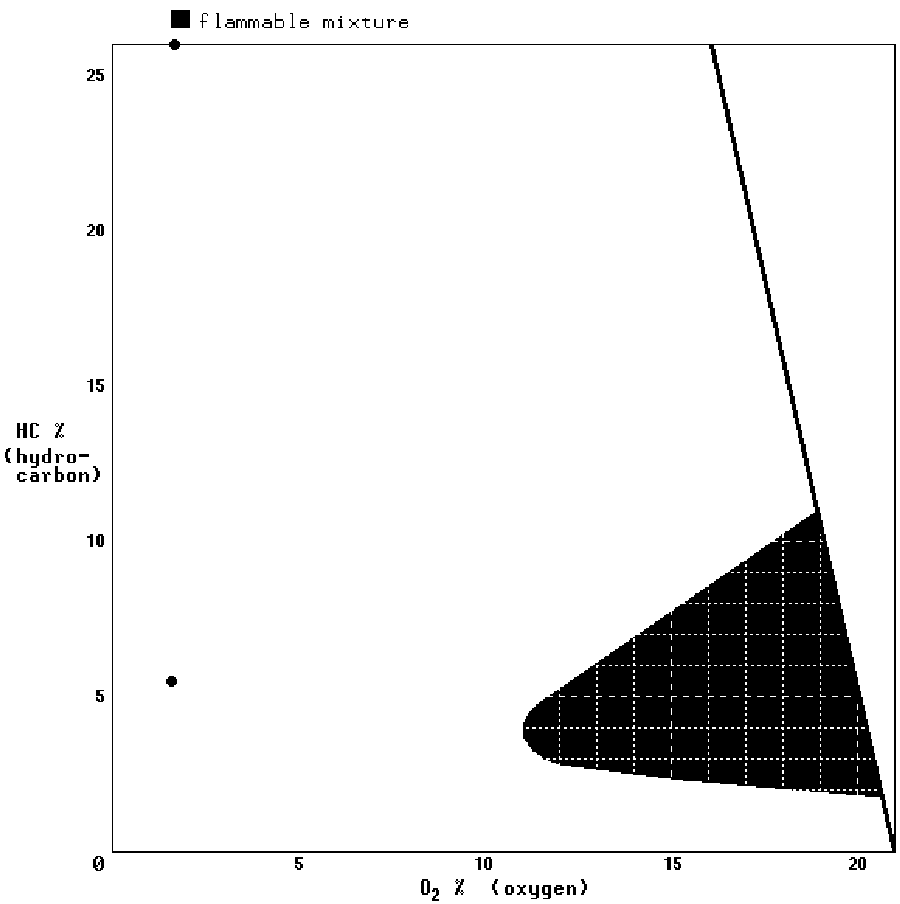
O_2	X	1.59	A	%
HC	X	5.51		%
Pressure	P	0.03	A	bar

TANK ATMOSPHERE

O_2	X	1.68	A	%
HC	X	36.62		%
Pressure	P	0.03	A	bar

MISC. TANK DATA

Volume	V	87.19	%-full
Dens. oil	D	819.99	kg/m^3
Dens. water	D	1025.0	kg/m^3
L/Disch.Rate	G	2924.5	m^3/h
Liq.Content	M	21547.	tonnes



CHT2000-VLCC-II REV: 1.3

5.6 Inerting Procedures

5.6.1 General

Inert Gas is a non inflammable gas such as CO_2 or N_2 that does not support combustion. No oil burner is 100 % perfect. It is therefore necessary to add more than the theoretical needed amount of air and this result in an excess of O_2 and CO content in fluegas as a result of incomplete combustion.,

Not all of the oxygen in the air will be combusted, and some fuel will not get sufficient oxygen for complete combustion. Therefore some carbon monoxide (CO) will remain. The sulphur dioxide (SO_2) comes from the sulphur content in the fuel and the water vapour comes from the combustion of the fuel hydrogen compounds.

1 kg. fuel oil combusted in the boiler, with normal excess of air, gives approximately. 12 m^3 Inert Gas after passing the scrubber (cooling tower). Under normal service conditions of the boiler for this particular ship, the fuel oil consumption is about 6,000 kg/h. The capacity of the Inert Gas plant is 40,000 m3/h, which means that approximately 50 % of the total amount of flue gas passes through the Inert Gas plant.

To comply with IMO Rules, the O_2 content is not to exceed 5 % in the Inert Gas main supply line or 8 % in cargo tanks.

5.6.2 Inert Gas Policy

All cargo tanks to be inerted at all times, except when entering is necessary.

Cargo tanks are to be kept in inerted condition whenever they contain cargo, residues or ballast. The oxygen content is to be kept at 8 % or less by volume with a positive gas pressure in all cargo tanks.

When cargo tanks are gas free on arrival at the loading port , the tanks are to be inerted before they are loaded.

Purge cargo tanks with Inert Gas to make the transition from Cargo vapour condition to gas-free condition without passing through the explosive limits.

In order to maintain cargo tanks in a non flammable condition, the Inert Gas plant will be operated to:

- Inert empty cargo tanks.

- Supply positive pressure during cargo discharge, deballasting and as necessary in other tank operations.

- Top-up pressure in the cargo tanks, when necessary, during the voyage.

5.6.3 Inerting Empty Tanks

When inerting empty tanks which are gas free, following a dry-docking or tank entry, Inert Gas should be introduced through the distribution system while the air in the tank is vented into the atmosphere via the P/V by-pass.

Inerting should continue until all the tanks have an O_2 content of less than 8 % by volume. Tanks with wash bulkhead may provide pockets of high O_2 content. These tanks should be doubled checked.

The process can be monitored from the respective Tank Atmosphere Pictures (MD 222 - 235).

On the completion of inerting, all tanks should be consistently pressured and with Inert Gas. A positive pressure of at least 0,1 Bar can be maintained by topping up with Inert Gas as necessary.

Loading must not be started until the vessel's cargo tanks are fully inerted.

5.6.4 Inerting during Deballasting

Deballasting from cargo tanks should not start until:

- All cargo tanks, including slop tanks, are connected to the Inert Gas main. All Inert Gas tank isolating valves are locked open.
- All other cargo tank and slop tank openings, including P/V by-pass are closed.
- The Inert Gas plant is producing Inert Gas with O_2 content of 5 % or less.

When loading and deballasting concurrently, pressures throughout the Inert Gas system must be carefully monitored.

5.6.5 Inerting during COW and Water Washing

Before each tank is washed, the O_2 content is not to exceed 8 % by volume. The O_2 content and Inert Gas pressure must be continuously recorded during the washing operation. If the O_2 content exceeds 8 % or the tank atmosphere is no longer positive, the washing operation must be stopped until satisfactory conditions are restored.

5.6.6 Inerting during Loading

When loading cargo, the Inert Gas main deck isolating valve is to be closed and the inert gas plant shut down unless other cargo tanks are being deballasted simultaneously. The Inert Gas deck branch valves must be locked in open position.

During the loaded voyage a positive pressure of at least 0,1 Bar must be maintained. Loss of pressure can be caused by leakage from tank openings or by falling air and sea temperatures.

5.6.7 Inerting during Discharging

Cargo discharge shall not be started until:

- All cargo tanks, including slop tanks, are connected to the Inert Gas main. All Inert Gas tank valves are locked open.
- All other cargo tank and slop tank openings, including P/V by-pass are closed.
- The Inert Gas plant is operating, producing Inert Gas with an O_2 content of no more than 5 %.

Inert Gas purging prior to Gas Freeing

When it is necessary to render a tank gas free after washing, the concentration of hydrocarbon vapour must be reduced by purging the inerted cargo tank with Inert Gas until the hydrocarbon content of the tank atmosphere has been reduced to 2 % by volume.

Care must be taken to ensure that testing is representative of the entire tank atmosphere.

5.6.9 Gas Freeing

Gas freeing of cargo tanks is only to be carried out when tank entry is essential. Gas freeing is not to be started until the hydrocarbon gases have been purged from the tank to a dilution of 2 % or less. The tank being gas freed is to be positively isolated from Inert Gas, deck main line and from other tanks.

Gas freeing is to continue until the entire tank has an O_2 content of 21 % by volume and a reading of less than 1 % of the lower flammable limit (L.E.L) is obtained. Care must be taken to prevent the leakage of air into inerted tanks, or of Inert Gas into tanks which are being gas freed.

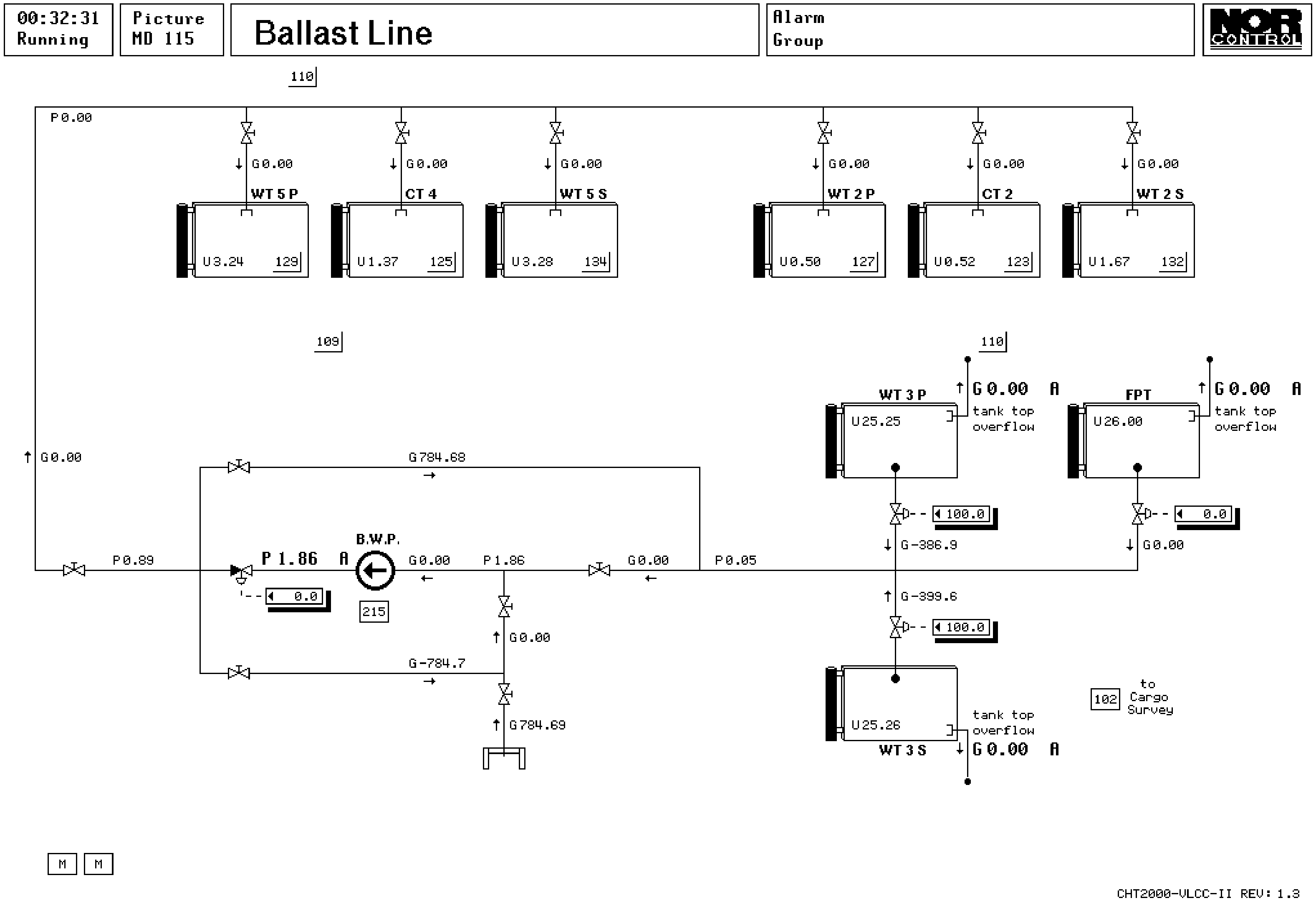
5.6.10 Inert Gas Emergency Procedure

In the event of Inert Gas system failure, such as:

- Inability to deliver the required quantity and/or quality of Inert Gas.
- Inability to maintain required pressure in the cargo tanks.
- Shut down of the Inert Gas plant.

Immediate action must be taken to prevent any air being drawn into the tanks. All discharging, deballasting or tank washing must cease and Inert Gas main deck isolating valve must be closed.

Cargo operations must not resume until the Inert Gas plant is returned to service and the tanks are satisfactorily inerted.


00:32:31
Running
Picture
MD 115
Ballast Line
Alarm
Group
110
P 0.00
G 0.00
WT 5 P
CT 4
WT 5 S
WT 2 P
CT 2
WT 2 S
U 3.24 129
U 1.37 125
U 3.28 134
U 0.50 127
U 0.52 123
U 1.67 132
109
110
WT 3 P
G 0.00 A
tank top overflow
U 25.25
FPT
G 0.00 A
tank top overflow
U 26.00
G 784.68
100.0
0.0
G -386.9
G 0.00
P 0.89
P 1.86 A
B.W.P.
G 0.00
P 1.86
G 0.00
P 0.05
0.0
215
G -399.6
100.0
G 0.00
G -784.7
G 784.69
U 25.26
tank top overflow
WT 3 S
G 0.00 A
102
to Cargo Survey
M
M
CHT2000-VLCC-II REV: 1.3

5.7 Ballasting

Ballasting is a process where by sea water is loaded into the cargo tanks or into segregated ballast tanks to ensure proper immersion and to provide good manoeuvring and stability characteristics. In order to lessen hull immersion and thus reduce fuel consumption, minimum quantities of ballast should be taken. However, the quantity must be sufficient to submerge the propeller, maintain vessel manoeuvrability, to avoid excessive vibration, to operate within approved stress limits and to retain sufficient bow immersion.

Ballast should be evenly distributed to minimise stress. Tanks should be either empty or full. Partially full or slack tanks should be avoided.

An appropriate stern trim will enhance propulsion efficiency. An optimum trim for the CHT 2000 VLCC-II-ws vessel is about 4.5 meters (15 feet).

Ballasting include handling three types of ballast:

- Segregated ballast.
- Dirty ballast (departure ballast).
- Clean ballast (arrival ballast).

5.7.1 Ballast Pump Ready

The ballast pump is ready for start-up if the mimic section is lit

Trip

The TRIP symbol is lit if one or more of the following condition are present:

- Steam supply pressure is too low.
- Condenser pressure is high.

These conditions can be set by the engineers (i.e. the instructor).

Starting Procedure

The pump is started by clicking the START symbol.

The following is normal start procedure for centrifugal type pumps:

- Close the discharging valve.
- Open the suction valve.
- Fill the pump with liquid (oil/water).
- Start the pump.
- Open the discharging valve.

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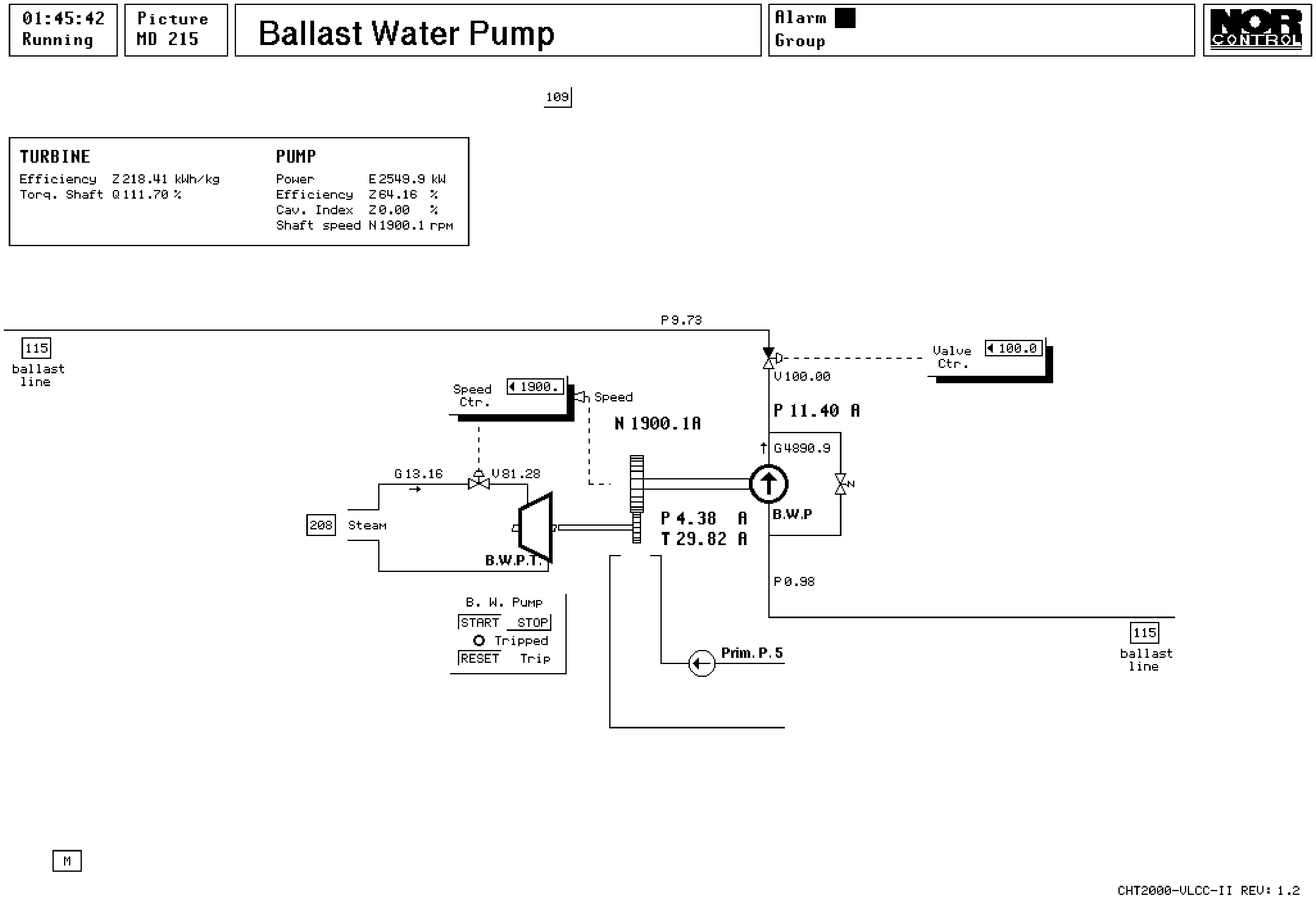

01:45:42
Running
Picture
MD 215
Ballast Water Pump
Alarm
Group
109
TURBINE
Efficiency Z 218.41 kWh/kg
Torq. Shaft Q 111.70 %
PUMP
Power E 2549.9 kW
Efficiency Z 64.16 %
Cav. Index Z 0.00 %
Shaft speed N 1900.1 rpm
P 9.73
115
ballast line
Valve Ctr.
100.0
V 100.00
Speed Ctr.
1900.
Speed
N 1900.1 A
P 11.40 A
G 4890.9
G 13.16
V 81.28
208
Steam
B.W.P.T.
P 4.38 A
T 29.82 A
B.W.P
P 0.98
B. W. Pump
START
STOP
Tripped
RESET
Trip
Prim. P. 5
115
ballast line
M
CHT2000-VLCC-II REV: 1.2

Pump Speed

The set-point of the pump turbine governor, which regulates the pump speed, is controlled by clicking on the Speed control and entering the new set point.

Open/Close

The discharge valve setting is controlled by means of entering the new value (0-100%).

The pump flow and the pump pressure is controlled by the pump speed setting and the discharge valve setting.

High bearing temp

Running of the pump at a substantial speed against a high discharge pressure may cause high bearing temperature after a certain period of time, even if the discharge valve is equipped with a recirculating release valve.

The performance of the pump turbine is dependent on the steam supply pressure and temperature, as well as the condenser vacuum. These parameters will vary with the pump turbine load.

Reset trip

The pump trip is indicated by a flashing light on the pump control section. Before the pump can be re-started the trip has to be reset. This is done by clicking the reset symbol after the pump has stopped. The flashing light in the pump control section will then extinguish if the cause for the trip has disappeared, or turn to steady light if the cause for the trip still is present. This can then be reminded by the engineer (i.e. the instructor).

Trip Causes

The cause for the trip may be printed out on the instructor's printer, and it can be identified on the display and on the instructor's VDU. The trip causes are:

- Overspeed.
- Lub. oil pressure low.
- Bearing temp. high.
- Discharge pressure high.

Stopping

The pump is stopped by clicking the STOP symbol. The turbine steam supply valve is closed and the pump is brought to stop after a while.

5.7.2 Segregated Ballast

The Segregated Ballast Tanks (SBT) are completely separate from the cargo oil and fuel system and are permanently allocated to the carriage of clean ballast water only. SBT require separate pumps and pipes dedicated to handling ballast water only.

The modelled SBT are WT. 3 P+S and FP and ballast can be pumped to/from tanks by the ballast pump in the cargo pump room.

Segregated ballast may be retained on board in order to restrict the air draught, if necessary because of weather conditions, or restrictions of loading arms or shore gangway. However, care must be taken not to exceed the maximum draught for the Terminal or for hull stress.

5.7.3 Dirty Ballast (Departure Ballast)

Dirty Ballast is pumped into WT 2 P+S and WT 5 P+S via the ballast pump and separate ballast drop lines. This operation can be performed during discharging and after the tanks have been COW-ed. Dirty Ballast tanks can be deballasted only by using the cargo pumps and lines.

It is now common practice to discharge all cargo tanks before ballast is pumped into any cargo tanks. This practice is followed in order to avoid claims for short discharging and/or ROB (Remaining on Board)

If it is necessary because of draught/air draught/trim/stress, to ballast empty cargo tanks while simultaneously discharging other cargo tanks, ensure that the following conditions are met:

- A proper line strip is done, and tanks are completely drained of cargo.
- These results should be verified by Terminal representative (surveyor).
- Obtain written permission to ballast and a dry tank inspection certificate.
- If any of these conditions cannot be met, note this in the record, and also note the time, date and name of representative.

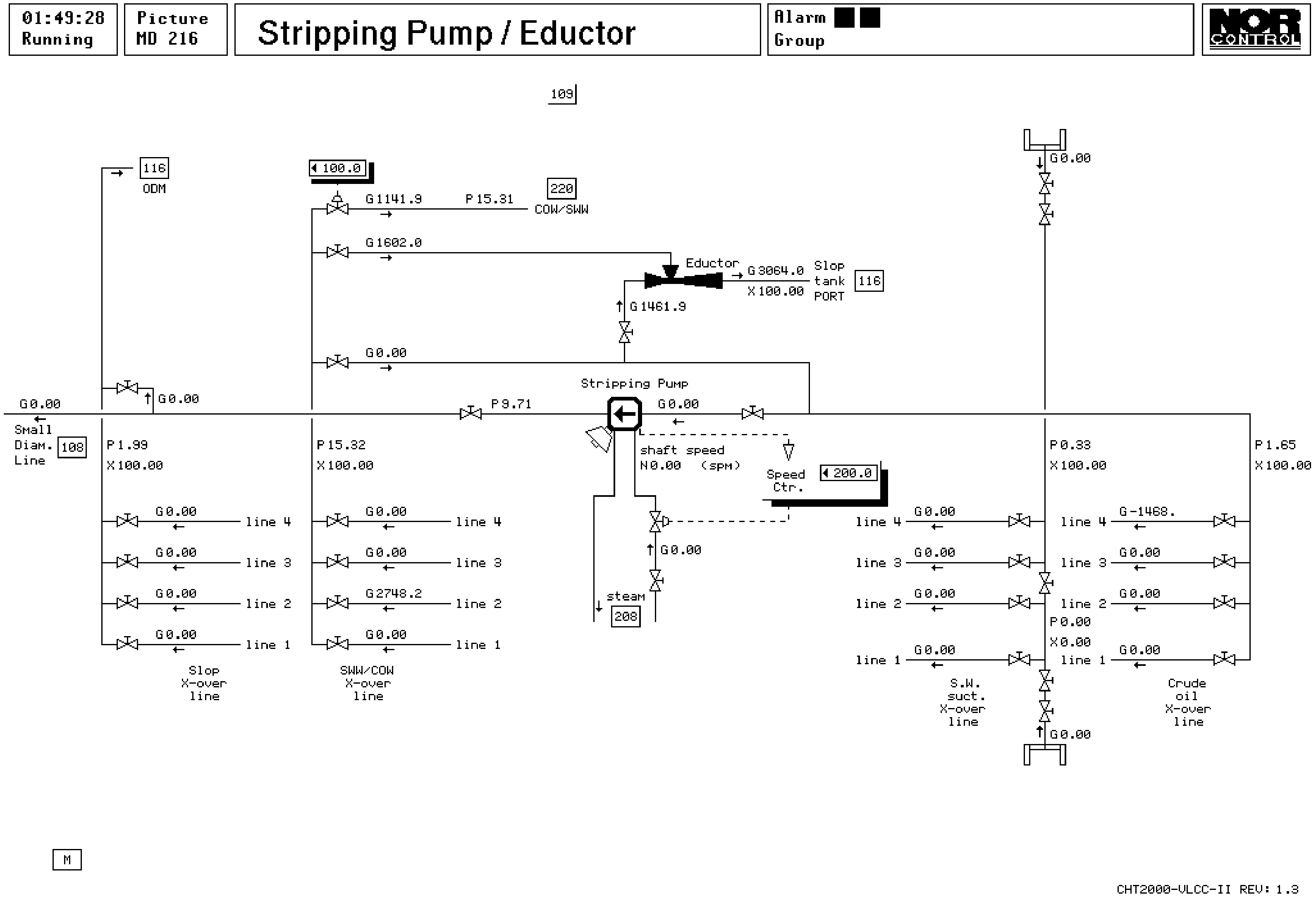
Ballast that is loaded directly into cargo tanks immediately after cargo discharge comes into contact and mingles with the oil that has remained in the tanks. The oily (dirty) ballast must be disposed off prior to arrival at the loading port, unless the loading port has suitable reception facilities.

5.7.4 Clean Ballast (Arrival Ballast

Unless it is otherwise specified in the Voyage Orders, the vessel should arrive load port with clean ballast and also with decanted slops, in accordance with LOT (Load on Top procedures).

Clean arrival ballast is normally filled into one or more CT after the dedicated tanks have been cleaned.

CT 2 and 4 can be ballasted by using the ballast pump and drop lines. Any other CT must be ballasted by using the cargo pumps and lines. The Clean Ballast tanks can only be deballasted by using the cargo pumps and lines, and therefore considerable pump and line flushing must take place before any overboard discharge of ballast can occur. These flushings may not be discharged over board or back-flushed into the ballast tanks, since these tanks have been thoroughly cleaned and must remain clean. Pump and line flushing must therefore be transferred to the slop tanks.


01:49:28
Running
Picture
MD 216
Stripping Pump / Eductor
Alarm
Group
NOR CONTROL
109
116
ODM
100.0
G 1141.9
P 15.31
220
COW/SWW
G 1602.0
Eductor
G 3064.0
X 100.00
Slop
tank
PORT
116
G 1461.9
G 0.00
Stripping Pump
P 9.71
G 0.00
Small
Diam.
Line
108
P 1.99
X 100.00
P 15.32
X 100.00
shaft speed
N 0.00 (spm)
Speed
Ctr.
200.0
P 0.33
X 100.00
P 1.65
X 100.00
line 4
line 3
line 2
line 1
G 2748.2
G -1468.
steam
208
P 0.00
X 0.00
Slop
X-over
line
SWW/COW
X-over
line
S.W.
suct.
X-over
line
Crude
oil
X-over
line
M
CHT2000-VLCC-II REV: 1.3

5.7.5 Stripping

Stripping can be carried out by using:

- The stripping pump.
- The eductor.
- The vacuum strip.

During stripping operations the main suction valves should preferably be shut, while the throttled stripping valves should be kept open.

The main valves are located higher in the tanks than the stripping valves and not so close to the bulkheads, either i.e. :

- By using the stripping valves instead of the main valves during the stripping procedure influx of air/inert gas into the bottom lines will be reduced.
- By using the stripping valves while heeling and/or trimming the ship, a large amount of the remaining tank content can be stripped off.

5.7.6 The Stripping Pump

The stripping pump can be started from control section of **picture MD 216** by opening the steam supply valve. When the pump is running, the pump symbol will change colour. There is no "READY" indication for this pump.

Speed Control

The set-point of the pump governor, which regulates the pump speed, is controlled by entering a new set point on the speed control section.

The stripping pump is basically used for stripping cargo from pumps and lines into the small diameter line on completion of discharging. However, the stripping pump can also be used to perform any kind of stripping from lines and/or cargo tanks into cargo discharge lines and into both slop tanks through the Oil Discharge Monitor.

Stopping

The pump is stopped by closing the steam supply valve with the right mouse button. The turbine steam supply valve is closed and the pump is brought to stop after a while.

5.7.7 The Eductor

The eductor is operated from the **picture MD 216**, provided one of the cargo pumps is running.

Open valves to enable the driving pump to suck water/oil from the respective source and to deliver it into the port slop tank via the eductor.

Start the driving pump and adjust to deliver the required driving pressure. The pressure of the driving medium should be set according to the level in the port slop tank.

As soon as the driving pump delivers with normal working pressure, the suction valve(s) can be opened.

The suction valve(s) are not to be opened until the required pressure has been obtained, because if the pressure is lower than approx. 3.0 bar the driving medium may run in the wrong direction and fill the tanks instead of emptying them.

Before stopping the driving pump, the suction valve(s) should be closed to prevent water/oil from entering the cargo compartments.

The eductor is installed to eliminate use of the stripping pump during tank cleaning. If the eductor is used for COW or stripping of cargo, the eductor must be driven with the same type of driving medium as the cargo to be stripped out. In order to avoid filling up the slop tank too quickly the driving medium should be taken from the slop tank.

The drawback of using the eductor for cargo stripping is that the stripping puts liquid into the port slop tank which later has to be discharged ashore by means of an ordinary pump.

5.7.8 The Vacuum Strip (Oil/Gas Separator

The cargo pumps are furnished with oil/gas separators with vacuum pumps. The vacuum pumps are started automatically at low liquid level in the separator tanks. The status of the vacuum pump is shown by a lit symbol.

The system provides automatic throttle control of the COPs in such a way that the cargo tanks are emptied without use of conventional stripping pumps. A butterfly valve in the pressure line of the cargo pumps controls pump throughput to follow varying suction demands as oil level falls in the cargo tanks.

Entrained and occluded gases entering the suction line are separated out before the liquid reaches the pump inlet. Air and gas are separated off in the separator tank and pass through its upper section. Condensate from evacuated gas is separated off in the seal-water tank, while vapour is transferred to the sloptanks.

However, if the liquid level in the oil/gas separator becomes too low, gas or air can enter into the pump and cause a lost pumping capability with pump overspeed and cavitation.

This will be the case if the vacuum pump does not start automatically at low level. (It can be demonstrated by setting the vacuum pump in manual).

For training purposes the pump speed and the discharge valve opening can be controlled separately. However, modern cargo control techniques for prevention of cavitation and overspeed is available. This includes "Speed Surge Control" and "Flow Surge Control".

5.7.9 Line Stripping

On completion of discharge all cargo lines and pumps are to be emptied by the stripping pump and discharged to the shore installation via the small diameter line.

NOTE: If the air venting cock on the deck line is closed, the draining of the deck line will not occur.

Procedure for stripping of deck line no. "n".

- Keep the Cargo Pump no. "n" stopped, (**picture MD 211 - 214**).
- Open the Deck Line Air Venting Cock, (**picture MD 108**).
- Keep open the Deck Line Valve, (**picture MD 108**).
- Open the TC/COW X-Over Valve, (**picture MD 216**).
- Open the TCOWC/COSC connection Valve, (**picture MD 216**).
- Open the Stripping Pump Suction Valve, (**picture MD 216**).

- Open the Stripping Pump Discharge Valve, (**picture MD 216**).
- Open the Small Dia - Line Manifold Valve, (**picture MD 108**).
- Start the Stripping Pump, (**picture MD 216**).

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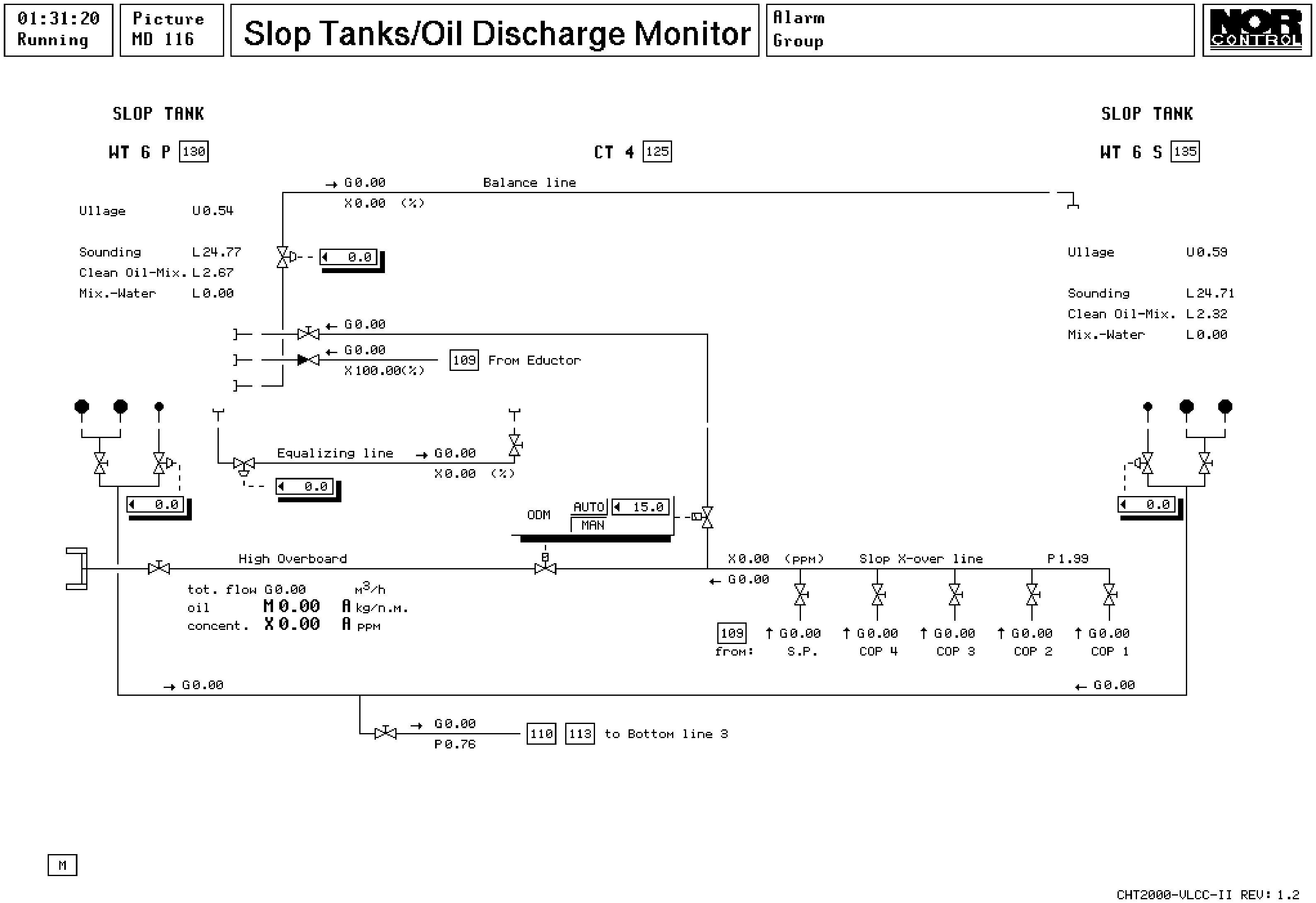


01:31:20
Running
Picture
MD 116
Slop Tanks/Oil Discharge Monitor
Alarm
Group
SLOP TANK
WT 6 P 130
CT 4 125
SLOP TANK
WT 6 S 135
Balance line
Ullage U0.54
Sounding L24.77
Clean Oil-Mix. L2.67
Mix.-Water L0.00
Ullage U0.59
Sounding L24.71
Clean Oil-Mix. L2.32
Mix.-Water L0.00
109 From Eductor
Equalizing line
ODM
AUTO
MAN
15.0
High Overboard
Slop X-over line
tot. flow G0.00 m3/h
oil M0.00 A kg/n.m.
concent. X0.00 A ppm
S.P.
COP 4
COP 3
COP 2
COP 1
110
113
to Bottom line 3
M
CHT2000-VLCC-II REV: 1.2

5.7.10 Slop

The slop consists of mixed oil and dirty water.

The slop tanks are used to segregate these two fluids from each other.

5.7.11 Double Slop Tank System

The slop tanks are arranged in a double tank system, where the port slop tank is the primary slop and the starboard slop tank is the secondary slop. The system works on the following principles:

- The mixture of oil and dirty water is pumped to the port slop tank for main separation.
- When the oil and water has separated, the oil is on top and the water on bottom.
- The water which has settled out can be decanted to the starboard slop tank.
- When the water in the starboard slop tank is pumped overboard, the content in the Overboard Discharge Line can be manually inspected. In addition, it is automatically monitored by the ODM.

5.7.12 Filling the Port Slop Tank

Before a mixture of oil and water is pumped into the port slop tank, it is necessary that there is clean water in the suction piece of the slop decanting line between the port and the starboard slop tank. (The Clean Water Interface Level, Port Slop Tank must be higher than the Decanting Line Outlet Height, Port).

When filling the port slop tank the clean water will be forced into the slop decanting line to prevent the entrance from clogging oil and dirt in the line.

5.7.13 Separation in the Port Slop Tank

After some time, the mixture of oil and water will separate.

5.7.14 Decanting the Port Slop Tank

- Check that appropriate fluid separation has taken place.
  Check : Clean Oil Interface Level.
  Check: Clean Water Interface Level.

- Check that the level in the port slop tank is substantially higher than the level in the starboard tank.

- Open the Interconnecting Valve in the Slop Decanting Line. A gravity flow between the port and starboard slop tank will start.

- Check continuously to ensure that clean water is flooding the suction piece of the slop decanting line. Check also to discover if any significant traces of oil are present in the slop decanting line.

If one of these events occurs, or as soon as the port and starboard slop tank levels have been equalised, the Slop Decanting Line Valve should be closed immediately.

5.7.15 Oil Discharge Monitor

The starboard slop tank can be emptied through the Overboard Line.

The following procedure can be followed:

- Open the Starboard Slop Tank Bottom Valves.
- Connect the starboard Slop Tank Bottom Valves to the Bottom line No.3 (Slop tanks isolating valve)
- Connect the suction side of cargo Pump No.3 (or any other cargo pump) to the Bottom Line.
- Connect the discharge side of the actual cargo pump to Slop crossover line.
- Start the cargo pump and open the discharge valve.
- Put the Oil Discharge Monitor in operation.

Manual mode

The Auto Overboard Valve and the Auto Recirculation Valve will remain open.

The Manual Overboard Valve to be kept open, and the sloptank port, dirty ballast inlet valve, to be kept closed, (**picture MD 116**).

If the Oil Discharge Monitor detects traces of oil, an alarm will be given.

The Discharge Valve should be closed immediately, (recirculation Valve may be opened).

Auto mode

The Auto Overboard Valve will stay open and the Auto Recirculation Valve will stay closed as long as no oil is detected in the overboard Line.

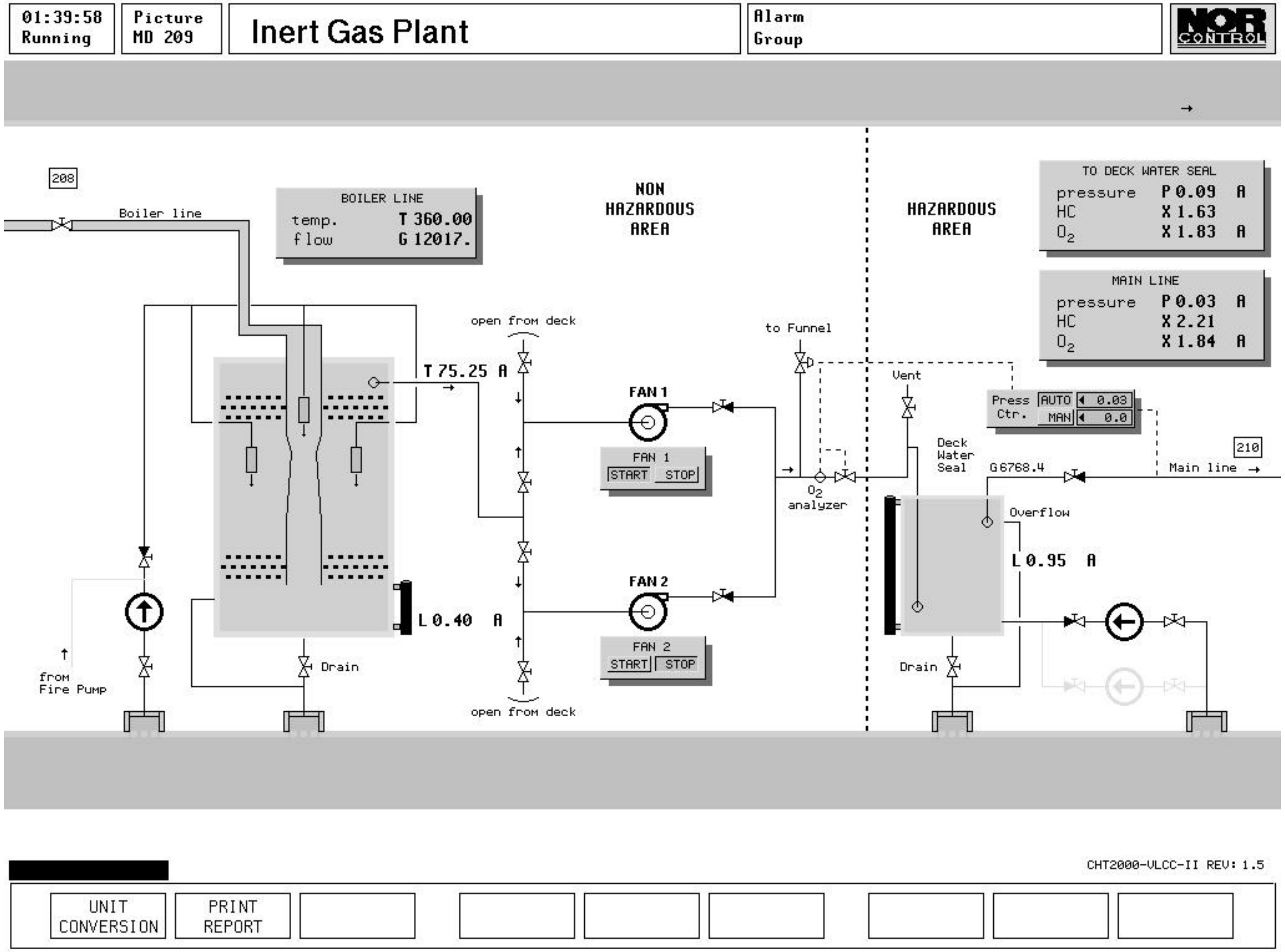
Both the Manual Overboard Valve and the Manual Recirculation Valve to remain open.

If oil is detected in the water, the Auto Overboard Valve will close and the Auto Recirculation Valve will open. An alarm will be given.

The valves will return to normal and the alarm will disappear as soon as no oil is detected in the water.

5.7.16 Oil Discharge Monitoring Variables

From the ODM variable list page 0064 one can monitor and alter the discharge values. However a total reset of the ODM can only be done if the ship state is in port condition (ref. page 0003 - Sea/ship state).



01:39:58
Running
Picture
MD 209
Inert Gas Plant
Alarm
Group
208
Boiler line
BOILER LINE
temp. T 360.00
flow G 12017.
NON HAZARDOUS AREA
HAZARDOUS AREA
TO DECK WATER SEAL
pressure P 0.09 A
HC X 1.63
O2 X 1.83 A
MAIN LINE
pressure P 0.03 A
HC X 2.21
O2 X 1.84 A
open from deck
to Funnel
T 75.25 A
FAN 1
FAN 1
START STOP
Vent
Press Ctr.
AUTO 0.03
MAN 0.0
210
Deck Water Seal
G 6768.4
Main line
O2 analyzer
Overflow
L 0.95 A
FAN 2
FAN 2
START STOP
L 0.40 A
from Fire Pump
Drain
open from deck
Drain
CHT2000-VLCC-II REV: 1.5
UNIT CONVERSION
PRINT REPORT

5.8 Inerting and Venting

The operator can carry out and control the following operations:

- Operation of inert gas plant and deck water seal.
- Inerting of cargo tanks.
- Ventilation (gas freeing) of cargo tanks

The Inert Gas plant is operated from the **picture MD 209**. The Inert Gas plant is simplified compared to a real plant, but most of the basic features are presented on the CHT2000-VLCC-II-ws. The inertgas plant must be started and tuned in due time before it is required to the tanks.

5.8.1 Start-up Procedures

1. Ensure that the oxygen analyser and Inert Gas pressure indicator are working.
2. Ensure the boiler is producing flue gas with an O_2 content of 5 % by volume or less.
3. Open IG control valve to Funnel 100% in manual mode.
4. Fill Scrubber and deckwater seal
5. Check that the air suction valves to deck are closed.
6. Open fluegas supply valve to the scrubber.
7. Open IG fan suction valve.
8. Start IG fan.
9. Open IG fan discharge valve.
10. Observe the O_2 content before Deckseal to equalise with O_2 content in boiler (Below 5%).
11. Open IG main control valve.
12. Open IG deck line supply valve.
13. Set the IG reciculation valve to AUTO mode or start closing the valve in MANUAL mode. Click in the pressure control box to get a pop-up diagram.
14. Observe O_2 content to deck seal equalise with O_2 content before Deckseal.
15. When O_2 content in deck line is OK, open IG supply valves to the Cargo tanks.

5.8.2 Shut down procedure

1. Open IG control valve to funnel 100% in MANUAL mode
2. Shut of IG supply valves to cargo tanks
3. Close Deckline supply valve and IG main control valve.
4. Shut down the blowers.
5. Close the blower suction and discharge valves.
6. Close the flue gas isolating valve.
7. Keep full water supply on the scrubber for a minimum of 1 hour.
8. Ensure that the water supply to the deck water seal is satisfactory. Open line venting valves and ventilate non hazardous area.

5.8.3 Inert/Vent

The operator can choose inerting or air venting by either clicking the Inert Gas suction valves or the air suction valves.

NOTE: Before commencing ventilation by fresh air, the tanks must be measured for hydro carbon gas concentration. If the readings indicate gas concentration above 2 % by volume, the tanks are to be purged with Inert Gas until the hydrocarbon gas concentration has decreased to less than 2 % by volume. This will ensure that the atmosphere is kept below the lower flammable limit throughout the ventilation process.

5.8.4 Inert Press/O_2-content

The Main Line Inert Gas Pressure and the Main Line Oxygen Content is controlled by automatic valves. The IG main control valve is controlled by an O2 analyser which will shut of the valve and open the control valve to funnel. if the O2 content exceeds 5%. If the valve closes due to high O2 content, it will have to be manually opened when the O2 content is brought down under 5%.

The IG pressure control valve will automatically regulate the flow to deck in order to keep the pressure at the selected setpoint when in AUTO mode.

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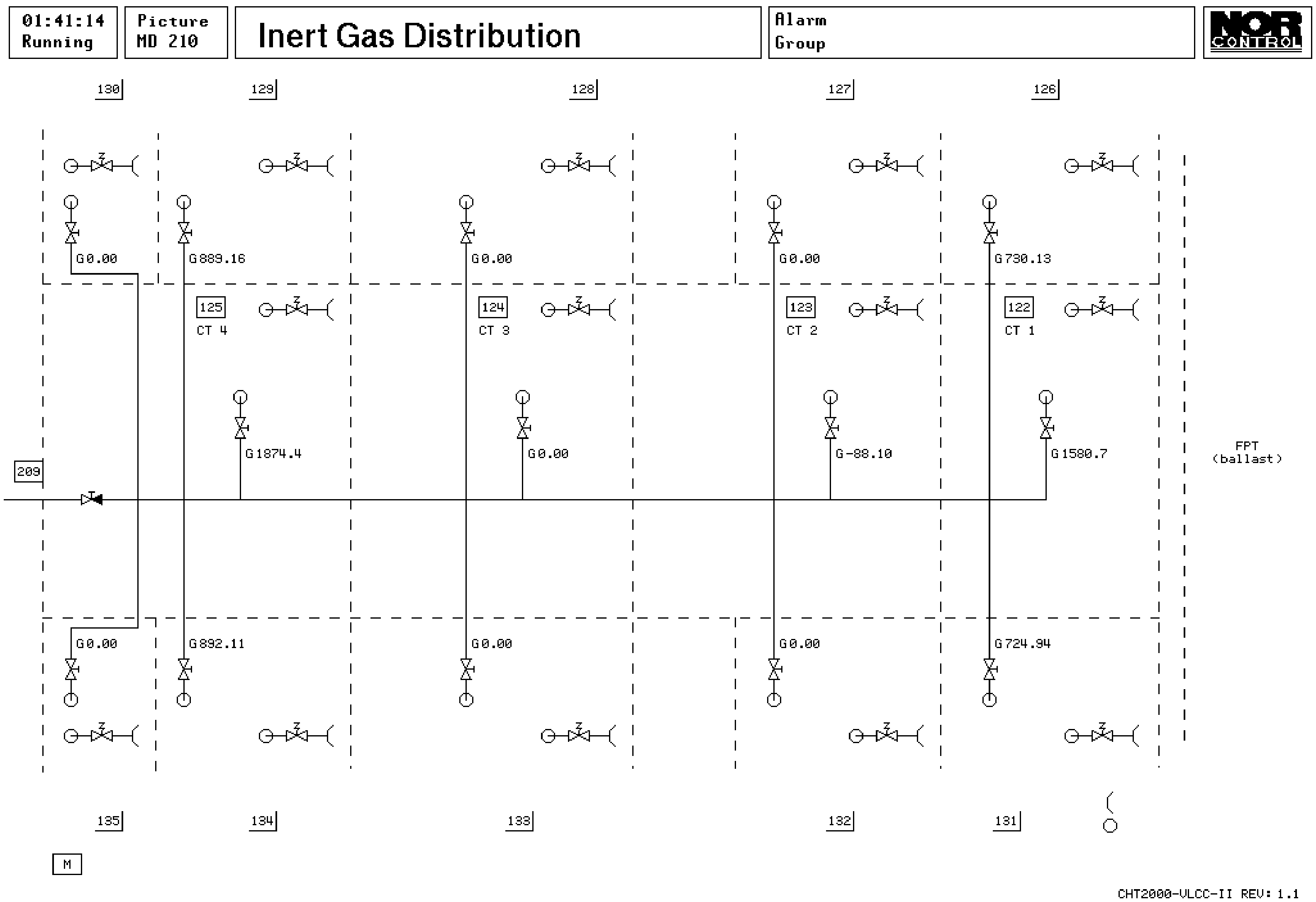

01:41:14
Running
Picture
MD 210
Inert Gas Distribution
Alarm
Group
130
129
128
127
126
G 0.00
G 889.16
G 0.00
G 0.00
G 730.13
125
CT 4
124
CT 3
123
CT 2
122
CT 1
G 1874.4
G 0.00
G -88.10
G 1580.7
FPT
(ballast)
209
G 0.00
G 892.11
G 0.00
G 0.00
G 724.94
135
134
133
132
131
M
CHT2000-VLCC-II REV: 1.1

5.8.5 Distribution

The Inert Gas can be distributed to the various tanks by operating the isolation valves. These valves are simulated by clicking on the Inert Gas Distribution **picture MD 210** An illuminated symbol indicates an open valve. These valves can also be operated from the Tank condition pictures (MD 122 - 135).

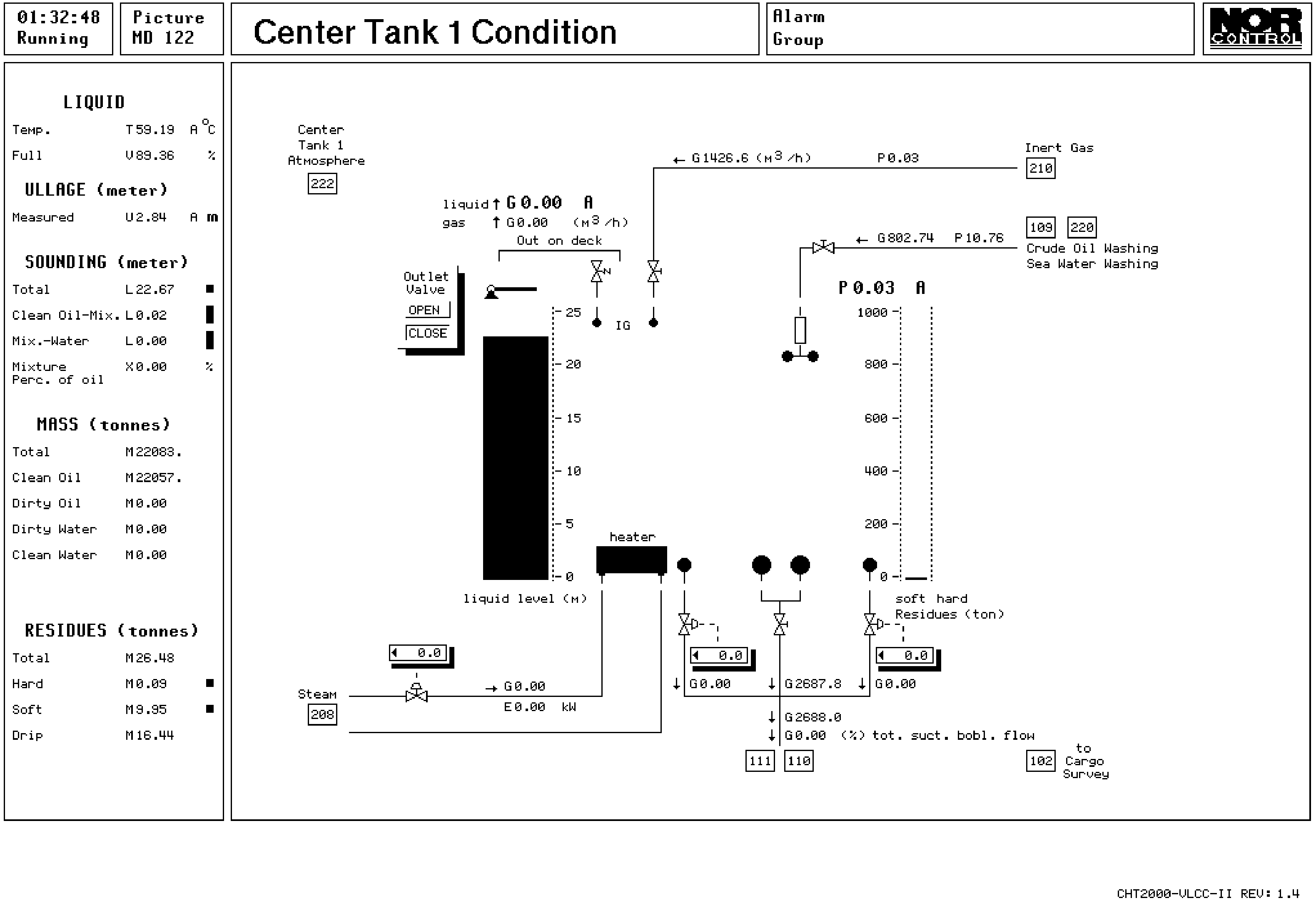
5.8.6 Tank Atmosphere Pressure Control

The gas pressure in the tanks is normally regulated by the automatic Pressure/Vacuum Valves. An open valve is indicated by illuminated actual P/V Valve.

During loading/discharging the gas pressure may change too much to be regulated by the P/V Valve. The P/V by-pass Valve (Tank hatch) may be opened. P/V by-pass valves should not be opened during the discharging operation because it will increase of O_2 in the cargo tanks atmosphere.

5.9 Tank Cleaning, Water and COW

Permanently, high capacity tank washing machines are installed in all tanks.
As a general rule all tank cleaning (TC) should take place in inerted atmosphere.and the O_2 concentration in the tank to be below 8 % by volume.


01:32:48
Running
Picture
MD 122
Center Tank 1 Condition
Alarm
Group
NOR CONTROL
LIQUID
Temp. T59.19 A °C
Full V89.36 %
ULLAGE (meter)
Measured U2.84 A m
SOUNDING (meter)
Total L22.67
Clean Oil-Mix. L0.02
Mix.-Water L0.00
Mixture Perc. of oil X0.00 %
MASS (tonnes)
Total M22083.
Clean Oil M22057.
Dirty Oil M0.00
Dirty Water M0.00
Clean Water M0.00
RESIDUES (tonnes)
Total M26.48
Hard M0.09
Soft M9.95
Drip M16.44
Center Tank 1 Atmosphere
222
← G1426.6 (m3/h) P0.03
Inert Gas
210
liquid ↑ G0.00 A
gas ↑ G0.00 (m3/h)
Out on deck
109 220
← G802.74 P10.76
Crude Oil Washing
Sea Water Washing
Outlet Valve
OPEN
CLOSE
IG
P0.03 A
1000
800
600
400
200
0
25
20
15
10
5
0
heater
liquid level (m)
soft hard
Residues (ton)
0.0
0.0
0.0
Steam
208
→ G0.00
E0.00 kW
G0.00
G2687.8
G0.00
G2688.0
G0.00 (%) tot. suct. bobl. flow
111 110
102
to Cargo Survey
CHT2000-VLCC-II REV: 1.4

5.9.1 Crude Oil Washing (COW)

Before departure on a ballast voyage, after the complete discharge of cargo, sufficient tanks shall have been crude oil washed to permit compliance with the draught and trim requirements during all phases of the ballast voyage. Account must be taken of the vessel's trading pattern and expected weather conditions. Ballast water should not be put into tanks which have not been crude oil washed.

Before, during and after COW operation check-lists must be completed and the student should pay particular attention to the following:

- Mixtures of crude oil and water can produce an electrically charged mist during washing. The use of "dry" crude oil is therefore important, and before washing begins any tank which is to be used as a source for crude oil washing fluid should be partly discharged to remove any water which has settled out during the voyage. The discharge of a layer at least one metre in depth is necessary for this purpose. For the same reason, if the slop tank is to be used as a source of oil for washing, it should first be completely discharged ashore and refilled with "dry" crude oil. Following checks must be performed prior to COW operation:

- The Inert Gas-plant is working properly and the oxygen content of delivered Inert Gas is below 5 % by volume.

- The oxygen content of tank(s) to be COW´ed is below 8 % by volume.

- All cargo tanks have positive pressure.

- The pressure in the COW line is as specified in the Manual.
- The trim will be satisfactory when bottom washing is in progress (as specified in the Manual).

- Cargo pumps, tanks, and pipe lines are properly drained after completion of COW.

5.9.1.1 COW Operation

The COW is performed from the **pictures MD 109,122 - 135 and 216** and is simulated in a simplified manner, but so that the basic factors are accounted for. In order to make the most out of the training, the students should have basic knowledge of rules and regulations related to the COW operation.

Crude Oil Supply On/off

The crude oil supply is turned on and off by clicking the valves routing from the tank to the COW washing machine.

COW Start/Stop

The COW - machine is started and stopped by clicking the COW supply valve on the tank condition mimic. The tanks to be COW'ed are selected from the workstation by means of clicking valve symbols.

Programming Tank cleaning machines

The tank cleaning machines are programmed by means of selecting the upper and lower limit in degrees by setting the required value in the control windows (MD 220).

CARGO HANDLING TRAINER

CHT2000-VLCC-II-ws

Appendix A

Trip Codes

1. APPENDIX A: TRIP CODES

This appendix shows the trip code and the failure/malfunction causing trip of the following machinery:

1.1 X2247 CARGO PUMP 1

1:	Overspeed	122% = 2169 rpm
2:	LO Press LL	0.40 bar
3:	Bearing Temp HH	80 Deg C
4:	Pump Discharge Pressure HH	250 mWC
5:	Low Inertgas Pressure(Main Line)	0.4 mWC

1.2 X2447 CARGO PUMP 2

1:	Overspeed	122% = 2169 rpm
2:	LO Press LL	0.40 bar
3:	Bearing Temp HH	80 Deg C
4:	Pump Discharge Pressure HH	250 mWC
5:	Low Inertgas Pressure Main Line)	0.4 mWC

1.3 X2647 CARGO PUMP 3

1:	Overspeed	122% = 2169 rpm
2:	LO Press LL	0.40 bar
3:	Bearing Temp HH	80 Deg C
4:	Pump Discharge Pressure HH	250 mWC
5:	Low Inertgas Pressure(Main Line)	0.4 mWC

1.4 X3047 CARGO PUMP 4

1:	Overspeed	122% = 2169 rpm
2:	LO Press LL	0.40 bar
3:	Bearing Temp HH	80 Deg C
4:	Pump Discharge Pressure HH	250 mWC
5:	Low Inertgas Pressure (Main Line)	0.4 mWC

1.5 X3247 BALLAST PUMP

1:	Overspeed	122% = 2169 rpm
2:	LO Press LL	0.40 bar
3:	Bearing Temp HH	80 Deg C
4:	Pump Discharge Pressure HH	250 mWC

CARGO HANDLING TRAINER

CHT2000-VLCC-II-ws

Appendix B

Alarm List
Doc.no.SO-0604

2. APPENDIX B: ALARM LIST

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Section **Page**

1. DIRECTORY LIST

1.1 Page:0100 TANK ULLAGE (2 pages)

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1.2 Page:0400 TANK INERT GAS PRESSURE (1 page)

Page:0500 TANK CARGO TEMPERATURE (1 page)
Page:0700 CARGO PUMP 1 SYSTEM (1 page)
Page:0800 CARGO PUMP 2 SYSTEM (1 page)
Page:0900 CARGO PUMP 3 SYSTEM (1 page)
Page:1000 CARGO PUMP 4 SYSTEM (1 page)
Page:1100 BALLAST PUMP SYSTEM (1 page)
Page:1300 HULL BENDING MOMENTS (1 page)
Page:1400 HULL SHEAR FORCES (1 page)
Page:1500 LOAD MASTER (2 pages)
Page:1900 INERT GAS SYSTEM (1 page)
Page:2000 OIL DISCHARGE MONITOR (1 page)

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2. VARIABLE LIST PAGES

2.1 Page:0100 AG01** TANK ULLAGE (1 - 2)

A:					
B:	U00012	m	L=0.5	H=25.0	FPT TANK ULLAGE (measured)
C:	U00112	m	L=0.5	H=25.0	CT1 TANK ULLAGE (measured)
D:	U00212	m	L=0.5	H=25.0	WT1S TANK ULLAGE (measured)
E:	U00312	m	L=0.5	H=25.0	WT1P TANK ULLAGE (measured)
F:	U00412	m	L=0.5	H=25.0	CT2 TANK ULLAGE (measured)
G:	U00512	m	L=0.5	H=25.0	WT2S TANK ULLAGE (measured)
H:	U00612	m	L=0.5	H=25.0	WT2P TANK ULLAGE (measured)
I:	U00712	m	L=0.5	H=25.0	WT3BS TANK ULLAGE (measured)
J:	U01012	m	L=0.5	H=25.0	WT3P TANK ULLAGE (measured)
K:	U01112	m	L=0.5	H=25.0	CT3 TANK ULLAGE (measured)
L:	U01212	m	L=0.5	H=25.0	WT4S TANK ULLAGE (measured)
M:	U01312	m	L=0.5	H=25.0	WT4P TANK ULLAGE (measured)
N:	U01412	m	L=0.5	H=25.0	CT4 TANK ULLAGE (measured)
O:	U01512	m	L=0.5	H=25.0	WT5S TANK ULLAGE (measured)
P:	U01612	m	L=0.5	H=25.0	WT5P TANK ULLAGE (measured)
Q:	U01712	m	L=0.5	H=25.0	WT6S TANK ULLAGE (measured)
R:	U02012	m	L=0.5	H=25.0	WT6P TANK ULLAGE (measured)

2.2 :0101 AG01** TANK TOP OVERFLOW (2 - 2)

A:					
B:	G00017	m3/s	L=0.0	H=1.0	FPT TANK TOP OVERFLOW
C:	G00117	m3/s	L=0.0	H=1.0	CT1 TANK TOP OVERFLOW
D:	G00217	m3/s	L=0.0	H=1.0	WT1S TANK TOP OVERFLOW
E:	G00317	m3/s	L=0.0	H=1.0	WT1P TANK TOP OVERFLOW
F:	G00417	m3/s	L=0.0	H=1.0	CT2 TANK TOP OVERFLOW
G:	G00517	m3/s	L=0.0	H=1.0	WT2S TANK TOP OVERFLOW
H:	G00617	m3/s	L=0.0	H=1.0	WT2P TANK TOP OVERFLOW
I:	G00717	m3/s	L=0.0	H=1.0	WT3BS TANK TOP OVERFLOW
J:	G01017	m3/s	L=0.0	H=1.0	WT3BP TANK TOP OVERFLOW
K:	G01117	m3/s	L=0.0	H=1.0	CT3 TANK TOP OVERFLOW
L:	G01217	m3/s	L=0.0	H=1.0	WT4S TANK TOP OVERFLOW
M:	G01317	m3/s	L=0.0	H=1.0	WT4P TANK TOP OVERFLOW
N:	G01417	m3/s	L=0.0	H=1.0	CT4 TANK TOP OVERFLOW
O:	G01517	m3/s	L=0.0	H=1.0	WT5S TANK TOP OVERFLOW
P:	G01617	m3/s	L=0.0	H=1.0	WT5P TANK TOP OVERFLOW
Q:	G01717	m3/s	L=0.0	H=1.0	WT6S TANK TOP OVERFLOW
R:	G02017	m3/s	L=0.0	H=1.0	WT6P TANK TOP OVERFLOW
S:					

T:

2.3 Page:0200 AG02** TANK OXYGEN CONTENT (1 - 1)

A:					
B:					
C:	X00127	%	L=0.0	H=8.0	CT1 OXYGEN CONTENT
D:	X00227	%	L=0.0	H=8.0	WT1S OXYGEN CONTENT
E:	X00327	%	L=0.0	H=8.0	WT1P OXYGEN CONTENT
F:					
G:	X00427	%	L=0.0	H=8.0	CT2 OXYGEN CONTENT
H:	X00527	%	L=0.0	H=8.0	WT2S OXYGEN CONTENT
I:	X00627	%	L=0.0	H=8.0	WT2P OXYGEN CONTENT
J:					
K:	X01127	%	L=0.0	H=8.0	CT3 OXYGEN CONTENT
L:	X01227	%	L=0.0	H=8.0	WT4S OXYGEN CONTENT
M:	X01327	%	L=0.0	H=8.0	WT4P OXYGEN CONTENT
N:					
O:	X01427	%	L=0.0	H=8.0	CT4 OXYGEN CONTENT
P:	X01527	%	L=0.0	H=8.0	WT5S OXYGEN CONTENT
Q:	X01627	%	L=0.0	H=8.0	WT5P OXYGEN CONTENT
R:	X01727	%	L=0.0	H=8.0	WT6S OXYGEN CONTENT
S:	X02027	%	L=0.0	H=8.0	WT6P OXYGEN CONTENT
T:					

2.4 Page:0400 AG04** TANK INERT GAS PRESSURE (1 - 1)

A:					
B:					
C:	P00126	bar	L=-0.1	H=0.1	CT1 TANK ATMOSPHERIC PRESSURE
D:	P00226	bar	L=-0.1	H=0.1	WT1S TANK ATMOSPHERIC PRESSURE
E:	P00326	bar	L=-0.1	H=0.1	WT1P TANK ATMOSPHERIC PRESSURE
F:					
G:	P00426	bar	L=-0.1	H=0.1	CT2 TANK ATMOSPHERIC PRESSURE
H:	P00526	bar	L=-0.1	H=0.1	WT2S TANK ATMOSPHERIC PRESSURE
I:	P00626	bar	L=-0.1	H=0.1	WT2P TANK ATMOSPHERIC PRESSURE
J:					
K:	P01126	bar	L=-0.1	H=0.1	CT3 TANK ATMOSPHERIC PRESSURE
L:	P01226	bar	L=-0.1	H=0.1	WT4S TANK ATMOSPHERIC PRESSURE
M:	P01326	bar	L=-0.1	H=0.1	WT4P TANK ATMOSPHERIC PRESSURE
N:					
O:	P01426	bar	L=-0.1	H=0.1	CT4 TANK ATMOSPHERIC PRESSURE
P:	P01526	bar	L=-0.1	H=0.1	WT5S TANK ATMOSPHERIC PRESSURE
Q:	P01626	bar	L=-0.1	H=0.1	WT5P TANK ATMOSPHERIC PRESSURE
R:	P01726	bar	L=-0.1	H=0.1	WT6S TANK ATMOSPHERIC PRESSURE
S:	P02026	bar	L=-0.1	H=0.1	WT6P TANK ATMOSPHERIC PRESSURE
T:					

2.5 :0500 AG05** TANK CARGO TEMPERATURE (1 - 1)

A:					
B:					
C:	T00153	degC	L=40.0	H=100.0	CT1 CARGO TEMPERATURE
D:	T00253	degC	L=40.0	H=100.0	WT1S CARGO TEMPERATURE
E:	T00353	degC	L=40.0	H=100.0	WT1P CARGO TEMPERATURE
F:					
G:	T00453	degC	L=40.0	H=100.0	CT2 CARGO TEMPERATURE
H:	T00553	degC	L=40.0	H=100.0	WT2S CARGO TEMPERATURE
I:	T00653	degC	L=40.0	H=100.0	WT2P CARGO TEMPERATURE
J:					
K:	T01153	degC	L=40.0	H=100.0	CT3 CARGO TEMPERATURE
L:	T01253	degC	L=40.0	H=100.0	WT4S CARGO TEMPERATURE
M:	T01353	degC	L=40.0	H=100.0	WT4P CARGO TEMPERATURE
N:					
O:	T01453	degC	L=40.0	H=100.0	CT4 CARGO TEMPERATURE
P:	T01553	degC	L=40.0	H=100.0	WT5S CARGO TEMPERATURE
Q:	T01653	degC	L=40.0	H=100.0	WT5P CARGO TEMPERATURE
R:	T01753	degC	L=40.0	H=100.0	WT6S CARGO TEMPERATURE
S:	T02053	degC	L=40.0	H=100.0	WT6P CARGO TEMPERATURE
T:					

2.6 Page:0700 AG07** CARGO PUMP 1 SYSTEM (1 - 1)

A:					
B:					
C:	X02247	<0-5>	L=0.0	H=1.0	COP1 TRIP INDICATION
D:					
E:	N02110	rpm	L=0.0	H=1950.0	COP1 SPEED
F:	P02115	bar	L=0.0	H=20.0	COP1 DISCHARGE PRESS (before choke)
G:	Z02107	%	L=0.0	H=40.0	COP1 CAVITATION INDEX
H:					
I:	P02241	bar	L=1.0	H=5.0	COP1 BEARING LO PRESSURE
J:	T02242	degC	L=0.0	H=60.0	COP1 BEARING TEMPERATURE
K:					
L:					
M:	L02132	m	L=1.0	H=5.0	COP1 SEPARATOR LEVEL
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.7 Page:0800 AG08** CARGO PUMP 2 SYSTEM (1 - 1)

A:					
B:					
C:	X02447	<0-5>	L=0.0	H=1.0	COP2 TRIP INDICATION
D:					
E:	N02310	rpm	L=0.0	H=1950.0	COP2 SPEED
F:	P02315	bar	L=0.0	H=20.0	COP2 DISCHARGE PRESS (before choke)
G:	Z02307	%	L=0.0	H=40.0	COP2 CAVITATION INDEX
H:					
I:	P02441	bar	L=1.0	H=5.0	COP2 BEARING LO PRESSURE
J:	T02442	degC	L=0.0	H=70.0	COP2 BEARING TEMPERATURE
K:					
L:					
M:	L02332	m	L=1.0	H=5.0	COP2 SEPARATOR LEVEL
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.8 :0900 AG09** CARGO PUMP 3 SYSTEM (1 - 1)

A:					
B:					
C:	X02647	<0-5>	L=0.0	H=1.0	COP3 TRIP INDICATION
D:					
E:	N02510	rpm	L=0.0	H=1950.0	COP3 SPEED
F:	P02515	bar	L=0.0	H=20.0	COP3 DISCHARGE PRESS (before choke)
G:	Z02507	%	L=0.0	H=40.0	COP3 CAVITATION INDEX
H:					
I:	P02641	bar	L=1.0	H=5.0	COP3 BEARING LO PRESSURE
J:	T02642	degC	L=0.0	H=70.0	COP3 BEARING TEMPERATURE
K:					
L:					
M:	L02532	m	L=1.0	H=5.0	COP3 SEPARATOR LEVEL
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.9 Page:1000 AG10** CARGO PUMP 4 SYSTEM (1 - 1)

A:					
B:					
C:	X03047	<0-5>	L=0.0	H=1.0	COP4 TRIP INDICATION
D:					
E:	N02710	rpm	L=0.0	H=1950.0	COP4 SPEED
F:	P02715	bar	L=0.0	H=20.0	COP4 DISCHARGE PRESS (before choke)
G:	Z02707	%	L=0.0	H=40.0	COP4 CAVITATION INDEX
H:					
I:	P03041	bar	L=1.0	H=5.0	COP4 BEARING LO PRESSURE
J:	T03042	degC	L=0.0	H=70.0	COP4 BEARING TEMPERATURE
K:					
L:					
M:	L02732	m	L=1.0	H=5.0	COP4 SEPARATOR LEVEL
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.10 Page:1100 AG11** BALLAST PUMP SYSTEM (1 - 1)

A:					
B:					
C:	X03247	<0-5>	L=0.0	H=1.0	BWP TRIP INDICATION
D:					
E:	N03110	rpm	L=0.0	H=1950.0	BWP SPEED
F:	P03115	bar	L=0.0	H=20.0	BWP DISCHARGE PRESS (before choke)
G:	Z03107	%	L=0.0	H=40.0	BWP CAVITATION INDEX
H:					
I:	P03241	bar	L=1.0	H=5.0	BWP BEARING LO PRESSURE
J:	T03242	degC	L=0.0	H=70.0	BWP BEARING TEMPERATURE
K:					
L:					
M:					
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.11 :1300 AG13** HULL BENDING MOMENTS (1 - 1)

A:					
B:	Q06021	ktonm	L=-300.0	H=300.0	BENDING MOMENT (section 1)
C:	Q06022	ktonm	L=-350.0	H=350.0	BENDING MOMENT (section 2)
D:	Q06023	ktonm	L=-500.0	H=500.0	BENDING MOMENT (section 3)
E:	Q06024	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 4)
F:	Q06025	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 5)
G:	Q06026	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 6)
H:	Q06027	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 7)
I:	Q06030	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 8)
J:	Q06031	ktonm	L=-500.0	H=500.0	BENDING MOMENT (section 9)
K:	Q06032	ktonm	L=-200.0	H=200.0	BENDING MOMENT (section 10)
L:	Q06033	ktonm	L=-200.0	H=200.0	BENDING MOMENT (section 11)
M:					
N:					
O:					
P:	X07021	<0-1>	L=0.0	H=1.0	HULL DAMAGE (caused by overload)
Q:					
R:					
S:					
T:					

2.12 Page:1400 AG14** HULL SHEAR FORCES (1 - 1)

A:					
B:					
C:	P06001	ktonn	L=-16.0	H=16.0	SHEAR FORCE (section 1)
D:	P06002	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 2)
E:	P06003	ktonn	L=-20.0	H=20.0	SHEAR FORCE (section 3)
F:	P06004	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 4)
G:	P06005	ktonn	L=-16.0	H=16.0	SHEAR FORCE (section 5)
H:	P06006	ktonn	L=-16.0	H=16.0	SHEAR FORCE (section 6)
I:	P06007	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 7)
J:	P06010	ktonn	L=-22.0	H=22.0	SHEAR FORCE (section 8)
K:	P06011	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 9)
L:	P06012	ktonn	L=-14.0	H=14.0	SHEAR FORCE (section 10)
M:	P06013	ktonn	L=-12.0	H=12.0	SHEAR FORCE (section 11)
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.13 Page:1500 AG15** LM: HULL BENDING MOMENTS (1 - 2)

A:					
B:	Q06421	ktonm	L=-300.0	H=300.0	BENDING MOMENT (section 1) (LM)
C:	Q06422	ktonm	L=-350.0	H=350.0	BENDING MOMENT (section 2) (LM)
D:	Q06423	ktonm	L=-500.0	H=500.0	BENDING MOMENT (section 3) (LM)
E:	Q06424	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 4) (LM)
F:	Q06425	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 5) (LM)
G:	Q06426	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 6) (LM)
H:	Q06427	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 7) (LM)
I:	Q06430	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 8) (LM)
J:	Q06431	ktonm	L=-500.0	H=500.0	BENDING MOMENT (section 9) (LM)
K:	Q06432	ktonm	L=-200.0	H=200.0	BENDING MOMENT (section 10) (LM)
L:	Q06433	ktonm	L=-200.0	H=200.0	BENDING MOMENT (section 11) (LM)
M:					
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.14 :1501 AG15** LM: HULL SHEAR FORCES (2 - 2)

A:						
B:						
C:	P06401	ktonn	L=-16.0	H=16.0	SHEAR FORCE	(section 1) (LM)
D:	P06402	ktonn	L=-18.0	H=18.0	SHEAR FORCE	(section 2) (LM)
E:	P06403	ktonn	L=-20.0	H=20.0	SHEAR FORCE	(section 3) (LM)
F:	P06404	ktonn	L=-18.0	H=18.0	SHEAR FORCE	(section 4) (LM)
G:	P06405	ktonn	L=-16.0	H=16.0	SHEAR FORCE	(section 5) (LM)
H:	P06406	ktonn	L=-16.0	H=16.0	SHEAR FORCE	(section 6) (LM)
I:	P06407	ktonn	L=-18.0	H=18.0	SHEAR FORCE	(section 7) (LM)
J:	P06410	ktonn	L=-22.0	H=22.0	SHEAR FORCE	(section 8) (LM)
K:	P06411	ktonn	L=-18.0	H=18.0	SHEAR FORCE	(section 9) (LM)
L:	P06412	ktonn	L=-14.0	H=14.0	SHEAR FORCE	(section 10) (LM)
M:	P06413	ktonn	L=-12.0	H=12.0	SHEAR FORCE	(section 11) (LM)
N:						
O:						
P:						
Q:						
R:						
S:						
T:						

2.15 Page:1900 AG19** INERT GAS SYSTEM (1 - 1)

A:					
B:	L03534	m	L=0.5	H=0.8	IG DECK SEAL SW LEVEL
C:					
D:	P03555	bar	L=0.0	H=0.1	IG DECK LINE GAS PRESSURE
E:	X03556	%	L=0.0	H=7.0	IG DECK LINE OXY CONTENT
F:					
G:					
H:	P03550	bar	L=0.0	H=0.1	IG DISCHARGE LINE PRESSURE
I:	X03552	%	L=0.0	H=6.0	IG DISCHARGE LINE OXY CONTENT
J:					
K:	L03572	m	L=0.2	H=1.5	IG SCRUBBER SW LEVEL
L:	T03573	degC	L=20.0	H=100.0	IG SCRUBBER GAS OUTLET TEMP
M:					
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.16 Page:2000 AG20** OIL DISCHARGE MONITOR (1 - 1)

A:					
B:					
C:					
D:	X03600	ppm	L=0.0	H=15.0	OVERBOARD OIL CONTENT
E:					
F:	M03604	kg/Nm	L=0.0	H=20.0	SPECIFIC OIL DISCHARGE
G:					
H:					
I:					
J:					
K:					
L:					
M:					
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

CARGO HANDLING TRAINER

CHT2000-VLCC-II-ws

Appendix C

Malfunction List
Doc.no.SO-0605

3. APPENDIX C: MALFUNCTION LIST

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1. DIRECTORY LIST

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2. VARIABLE LIST PAGES

A: M0101 [0-100] CT 1 bottom valve V0135 leakage
B: M0102 [0-1] CT 1 bottom valve V0135 closed
C: M0103 [0-100] CT 1 bottom valve V0137 leakage
D: M0104 [0-1] CT 1 bottom valve V0137 closed
E: M0105 [0-1] CT 1 bottom valve V0136 leakage
F: M0106 [0-1] CT 1 bottom valve V0136 stuck
G: M0111 [0-100] CT 2 bottom valve V0435 leakage
H: M0112 [0-1] CT 2 bottom valve V0435 closed
I: M0113 [0-100] CT 2 bottom valve V0437 leakage
J: M0114 [0-1] CT 2 bottom valve V0437 closed
K: M0115 [0-1] CT 2 bottom valve V0436 leakage
L: M0116 [0-1] CT 2 bottom valve V0436 stuck
M:
N:
O:
P:
Q:
R:
S:
T:

2.1 Page:0200 MA02** CENTRE TANK 3/4 VALVES

A: M0201 [0-100] CT 3 bottom valve V1135 leakage
B: M0202 [0-1] CT 3 bottom valve V1135 closed
C: M0203 [0-100] CT 3 bottom valve V1137 leakage
D: M0204 [0-1] CT 3 bottom valve V1137 closed
E: M0205 [0-1] CT 3 bottom valve V1136 leakage
F: M0206 [0-1] CT 3 bottom valve V1136 stuck
G: M0211 [0-100] CT 4 bottom valve V1435 leakage
H: M0212 [0-1] CT 4 bottom valve V1435 closed
I: M0213 [0-100] CT 4 bottom valve V1437 leakage
J: M0214 [0-1] CT 4 bottom valve V1437 closed
K: M0215 [0-1] CT 4 bottom valve V1436 leakage
L: M0216 [0-1] CT 4 bottom valve V1436 stuck
M:
N:
O:
P:
Q:
R:
S:
T:

2.2 Page:0300 MA03** BALLAST TANK VALVES

A: M0301 [0-100] FPT bottom valve V0035 leakage
B: M0302 [0-1] FPT bottom valve V0035 closed
C: M0303 [0-100] WT3BS bottom valve V0735 leakage
D: M0304 [0-1] WT3BS bottom valve V0735 closed
E: M0305 [0-100] WT3P bottom valve V1035 leakage
F: M0306 [0-1] WT3P bottom valve V1035 closed
G:
H:
I:
J:
K:
L:
M:
N:
O:
P:
Q:
R:
S:
T:

2.3 Page:0400 MA04** WING TANK 1/2 VALVES

A: M0401 [0-100] WT1S bottom valve V0235 leakage
B: M0402 [0-1] WT1S bottom valve V0235 closed
C: M0403 [0-1] WT1S bottom valve V0236 leakage
D: M0404 [0-1] WT1S bottom valve V0236 stuck
E: M0405 [0-100] WT1P bottom valve V0337 leakage
F: M0406 [0-1] WT1P bottom valve V0337 closed
G: M0407 [0-1] WT1P bottom valve V0336 leakage
H: M0410 [0-1] WT1P bottom valve V0336 stuck
I: M0411 [0-100] WT2S bottom valve V0535 leakage
J: M0412 [0-1] WT2S bottom valve V0535 closed
K: M0413 [0-1] WT2S bottom valve V0536 leakage
L: M0414 [0-1] WT2S bottom valve V0536 stuck
M: M0415 [0-100] WT2P bottom valve V0637 leakage
N: M0416 [0-1] WT2P bottom valve V0637 closed
O: M0417 [0-1] WT2P bottom valve V0636 leakage
P: M0420 [0-1] WT2P bottom valve V0636 stuck
Q:
R:
S:
T:

2.4 Page:0500 MA05** WING TANK 4/5 VALVES

A:	M0501	[0-100]	WT4S	bottom valve V1235 leakage
B:	M0502	[0-1]	WT4S	bottom valve V1235 closed
C:	M0503	[0-1]	WT4S	bottom valve V1236 leakage
D:	M0504	[0-1]	WT4S	bottom valve V1236 stuck
E:	M0505	[0-100]	WT4P	bottom valve V1337 leakage
F:	M0506	[0-1]	WT4P	bottom valve V1337 closed
G:	M0507	[0-1]	WT4P	bottom valve V1336 leakage
H:	M0510	[0-1]	WT4P	bottom valve V1336 stuck
I:	M0511	[0-100]	WT5S	bottom valve V1535 leakage
J:	M0512	[0-1]	WT5S	bottom valve V1535 closed
K:	M0513	[0-1]	WT5S	bottom valve V1536 leakage
L:	M0514	[0-1]	WT5S	bottom valve V1536 stuck
M:	M0515	[0-100]	WT5P	bottom valve V1637 leakage
N:	M0516	[0-1]	WT5P	bottom valve V1637 closed
O:	M0517	[0-1]	WT5P	bottom valve V1636 leakage
P:	M0520	[0-1]	WT5P	bottom valve V1636 stuck
Q:				
R:				
S:				
T:				

2.5 Page:0600 MA06** WING TANK 6 VALVES

A:	M0601	[0-100]	WT6S	bottom valve V1735 leakage
B:	M0602	[0-1]	WT6S	bottom valve V1735 closed
C:	M0603	[0-1]	WT6S	bottom valve V1736 leakage
D:	M0604	[0-1]	WT6S	bottom valve V1736 stuck
E:	M0605	[0-100]	WT6P	bottom valve V2037 leakage
F:	M0606	[0-1]	WT6P	bottom valve V2037 closed
G:	M0607	[0-1]	WT6P	bottom valve V2036 leakage
H:	M0610	[0-1]	WT6P	bottom valve V2036 stuck
I:				
J:				
K:				
L:				
M:				
N:				
O:				
P:				
Q:				
R:				
S:				
T:				

2.6 Page:0700 MA07** DECK LINE VALVES

A: M0701 [0-100] deck line 1 valve V2225 leakage
B: M0702 [0-1] deck line 1 valve V2225 closed
C: M0703 [0-100] deck line 2 valve V2425 leakage
D: M0704 [0-1] deck line 2 valve V2425 closed
E: M0705 [0-100] deck line 3 valve V2625 leakage
F: M0706 [0-1] deck line 3 valve V2625 closed
G: M0707 [0-100] deck line 4 valve V3025 leakage
H: M0710 [0-1] deck line 4 valve V3025 closed
I:
J:
K:
L:
M:
N:
O:
P:
Q:
R:
S:
T:

2.7 Page:0800 MA08** LOAD LINE VALVES

A: M1001 [0-1] load line 1 valve V2226 leakage
B: M1002 [0-1] load line 1 valve V2226 closed
C: M1003 [0-1] load line 2 valve V2426 leakage
D: M1004 [0-1] load line 2 valve V2426 closed
E: M1005 [0-1] load line 3 valve V2626 leakage
F: M1006 [0-1] load line 3 valve V2626 closed
G: M1007 [0-1] load line 4 valve V3026 leakage
H: M1010 [0-1] load line 4 valve V3026 closed
I:
J:
K:
L:
M:
N:
O:
P:
Q:
R:
S:
T:

2.8 Page:0900 MA09** BOTTOM LINE VALVES

A: M1101 [0-1] bottom line 1 valve V2224 leakage
B: M1102 [0-1] bottom line 1 valve V2224 closed
C: M1103 [0-1] bottom line 2 valve V2424 leakage
D: M1104 [0-1] bottom line 2 valve V2424 closed
E: M1105 [0-1] bottom line 3 valve V2624 leakage
F: M1106 [0-1] bottom line 3 valve V2624 closed
G: M1107 [0-1] bottom line 4 valve V3024 leakage
H: M1110 [0-1] bottom line 4 valve V3024 closed
I:
J:
K:
L:
M:
N:
O:
P:
Q:
R:
S:
T:

2.9 Page:1000 MA10** CARGO PUMP 1/2

A: M1201 [0-100] Cargo pump 1 wear
B: M1202 [0-100] Cargo pump 1 LO filter dirty
C: M1203 [0-100] Cargo pump 1 turbine wear
D: M1204 [0-100] Cargo pump 1 governor unstable
E: M1205 [0-100] Cargo pump 2 wear
F: M1206 [0-100] Cargo pump 2 LO filter dirty
G: M1207 [0-100] Cargo pump 2 turbine wear
H: M1210 [0-100] Cargo pump 2 governor unstable
I:
J:
K:
L:
M:
N:
O:
P:
Q:
R:
S:
T:

2.10 Page:1100 MA11** CARGO PUMP 3/4

A: M1301 [0-100] Cargo pump 3 wear
B: M1302 [0-100] Cargo pump 3 LO filter dirty
C: M1303 [0-100] Cargo pump 3 turbine wear
D: M1304 [0-100] Cargo pump 3 governor unstable
E: M1305 [0-100] Cargo pump 4 wear
F: M1306 [0-100] Cargo pump 4 LO filter dirty
G: M1307 [0-100] Cargo pump 4 turbine wear
H: M1310 [0-100] Cargo pump 4 governor unstable
I:
J:
K:
L:
M:
N:
O:
P:
Q:
R:
S:
T:

2.11 Page:1200 MA12** BALLAST PUMP

A: M1401 [0-100] Ballast pump wear
B: M1402 [0-100] Ballast pump LO filter dirty
C: M1403 [0-100] Ballast pump turbine wear
D: M1404 [0-100] Ballast pump governor unstable
E:
F:
G:
H:
I:
J:
K:
L:
M:
N:
O:
P:
Q:
R:
S:
T:

2.12 Page:1300 MA13** INERT GAS SYSTEM

A: M1501 [0-100] CT1 P/V valve leakage
B: M1502 [0-100] WT1S P/V valve leakage
C: M1503 [0-100] WT1P P/V valve leakage
D: M1504 [0-100] CT2 P/V valve leakage
E: M1505 [0-100] WT2S P/V valve leakage
F: M1506 [0-100] WT2P P/V valve leakage
G: M1507 [0-100] CT3 P/V valve leakage
H: M1510 [0-100] WT3BS P/V valve leakage
I: M1511 [0-100] WT3BP P/V valve leakage
J: M1512 [0-100] CT4 P/V valve leakage
K: M1513 [0-100] WT5S P/V valve leakage
L: M1514 [0-100] WT5P P/V valve leakage
M: M1515 [0-100] WT6S P/V valve leakage
N: M1516 [0-100] WT6P P/V valve leakage
O:
P:
Q:
R:
S:
T:

2.13 Page:1400 MA14** MISCELLANEOUS

A: M1601 [0-1] Plug in BALANCE line
B: M1602 [0-1] Plug in EQUALIZING line
C: M1603 [0-100] SWSC sea chest inlet (STBD) dirty
D: M1604 [0-100] SWSC sea chest inlet (PORT) dirty
E: M1605 [0-100] Ballast sea chest inlet dirty
F: M1606 [0-1] Hydraulic supply failure

CARGO HANDLING TRAINER

CHT2000-VLCC-II-ws

Appendix D

Variable List
Doc.no.SO-0606

4. APPENDIX D: VARIABLE LIST

TABLE OF CONTENTS

Section **Page**

1. DIRECTORY LIST

2. VARIABLE LIST PAGES

2.1 Page:0002 M** SIMULATOR TIME CONTROL

A:			
B:	X05014	<0-1>	GENERAL RESET COMMAND (time/monitors)
C:			
D:			
E:			
F:	X05013	<0-4>	TIME FACTOR INDEX (0-4) (input)
G:			
H:	Z05000	-	SIMULATION TIME SCALE (result)
I:	T05001	hour	SIMULATION PERIOD
J:			
K:			
L:			
M:	Z05006	-	TIME FACTOR 0
N:	Z05007	-	TIME FACTOR 1
O:	Z05010	-	TIME FACTOR 2
P:	Z05011	-	TIME FACTOR 3
Q:	Z05012	-	TIME FACTOR 4

2.2 Page:0003 M** SEA / SHIP STATE

A:			
B:	T04000	degC	SEA WATER TEMPERATURE
C:	D04001	kg/m3	SEA WATER DENSITY
D:			
E:	V04003	m/s	WIND SPEED
F:	T05002	hour	SOLAR TIME (temp influence)
G:			
H:	V04005	<0-1>	SHIP STATE (0=in port , 1=at sea)
I:	V04004	knots	SHIP SPEED COMMAND
J:	V04002	knots	SHIP SPEED
K:			
L:			
M:	L04011	m	DRAFT AFT
N:	L04012	m	DRAFT FORE
O:	L04015	m	DRAFT STBD
P:	L04016	m	DRAFT PORT
Q:			
R:	L04013	m	HULL TRIM
S:	L04014	m	HULL HEEL

2.3 Page:0004 M** SHORE CONNECTION DATA

A:			
B:	Z03700	-	SHORE PLANT MODE : 0=discharge , 1=load
C:			
D:	V02160	<0-1>	MANIFOLD 1 SHORE CONNECTION (stbd)
E:	V02360	<0-1>	MANIFOLD 2 SHORE CONNECTION (stbd)
F:	V02560	<0-1>	MANIFOLD 3 SHORE CONNECTION (stbd)
G:	V02760	<0-1>	MANIFOLD 4 SHORE CONNECTION (stbd)
H:			
I:	V02161	<0-1>	MANIFOLD 1 SHORE CONNECTION (port)
J:	V02361	<0-1>	MANIFOLD 2 SHORE CONNECTION (port)
K:	V02561	<0-1>	MANIFOLD 3 SHORE CONNECTION (port)
L:	V02761	<0-1>	MANIFOLD 4 SHORE CONNECTION (port)
M:			
N:	P03701	bar	DISCHARGE BACK PRESSURE (base)
O:	P03702	bar	DISCHARGE BACK PRESS RISE CONSTANT
P:	P03703	bar	LOAD BACK PRESSURE (base)
Q:	P03704	bar	LOAD BACK PRESSURE DROP CONSTANT
R:			
S:	T03706	degC	LOAD OIL TEMPERATURE
T:	D03707	kg/m3	LOAD OIL DENSITY

2.4 Page:0005 M** MANIFOLD VALVES AND FLOWS

A:			
B:	V12162	<0-1>	MANIFOLD 1 SHUT OFF VALVE (stbd)
C:	V12362	<0-1>	MANIFOLD 2 SHUT OFF VALVE (stbd)
D:	V12562	<0-1>	MANIFOLD 3 SHUT OFF VALVE (stbd)
E:	V12762	<0-1>	MANIFOLD 4 SHUT OFF VALVE (stbd)
F:			
G:	V12163	<0-1>	MANIFOLD 1 SHUT OFF VALVE (port)
H:	V12363	<0-1>	MANIFOLD 2 SHUT OFF VALVE (port)
I:	V12563	<0-1>	MANIFOLD 3 SHUT OFF VALVE (port)
J:	V12763	<0-1>	MANIFOLD 4 SHUT OFF VALVE (port)
K:			
L:	V02166	<0-1>	MANIF 1/2 CROSSOVER VALVE
M:	V02566	<0-1>	MANIF 3/4 CROSSOVER VALVE
N:			
O:			
P:	G02141	m3/h	LOAD FLOW (to bottom line 1)
Q:	G02341	m3/h	LOAD FLOW (to bottom line 2)
R:	G02541	m3/h	LOAD FLOW (to bottom line 3)
S:	G02741	m3/h	LOAD FLOW (to bottom line 4)
T:			

2.5 Page:0006 M** MANIFOLD MONITOR

A:			
B:			
C:	X03627	<0-1>	MANIFOLD MONITOR ACTIVE
D:	X03625	<0-1>	MANIFOLD MONITOR RESET COMMAND
E:			
F:			
G:	G03620	m3/h	TOTAL MANIFOLD FLOW (current)
H:	G03624	m3/h	TOTAL MANIFOLD FLOW (mean)
I:			
J:	M03622	ktonn	TOTAL MANIFOLD MASS
K:	T03623	hour	TOTAL MANIFOLD CONNECTION TIME
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.6 Page:0007 M** POLLUTION MONITOR

A:			
B:	X03636	<0-1>	POLLUTION MONITOR RESET COMMAND
C:			
D:			
E:	M03634	tonn	TOTAL TANK OVERFLOW OIL MASS
F:	M03626	tonn	TOTAL MANIFOLD SPILL OIL
G:	M03603	kg	TOTAL OVER BOARD DISCHARGED OIL MASS
H:			
I:	M03632	kg	TOTAL IG DISCHARGE MASS
J:	M03633	kg	TOTAL HC DISCHARGE MASS
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.7 Page:0008 M** PUMP WORK MONITOR

A:			
B:			
C:	X03720	<0-1>	PUMP MONITOR ACTIVE
D:	X03721	<0-1>	PUMP MONITOR RESET COMMAND
E:			
F:			
G:	M03722	ktonn	TOTAL PUMP 1-5 FLOW MASS
H:	E03723	MWh	TOTAL PUMP 1-5 ENERGY
I:			
J:	M03724	tonn	TOTAL TURBINE 1-5 STEAM MASS
K:	Z03725	US$	TOTAL TURBINE 1-5 STEAM COST
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.8 Page:0010 M** CARGO LINE 1 - VALVES

A:			
B:	V12162	<0-1>	MANIFOLD 1 SHUT OFF VALVE (stbd)
C:	V12163	<0-1>	MANIFOLD 1 SHUT OFF VALVE (port)
D:			
E:	V02166	<0-1>	MANIF 1/2 CROSSOVER VALVE
F:	V02164	<0-1>	MANIFOLD 1 DRAIN VALVE
G:			
H:	V02225	%	DECK LINE 1 SHUT OFF VALVE
I:	V02226	<0-1>	LOAD LINE 1 SHUT OFF VALVE
J:			
K:			
L:	V02222	<0-1>	TC/COW CROSSOVER VALVE
M:	V02223	<0-1>	SLOP CROSSOVER VALVE
N:	V02220	<0-1>	CO SUCTION CROSSOVER VALVE
O:	V02221	<0-1>	SW SUCTION CROSSOVER VALVE
P:			
Q:	V02224	<0-1>	BOTTOM LINE 1 SHUT OFF VALVE
R:	V02227	<0-1>	BOTTOM LINE 1/2 CONNECTION VALVE
S:	V02228	<0-1>	BOTTOM LINE 1/2 CONNECTION VALVE
T:			

2.9 Page:0011 M** CARGO LINE 1 - PUMP/TURBINE

A:					
B:	V02112	%			COP1 DISCHARGE VALVE POS
C:	V02113	%			COP1 DISCHARGE VALVE POS COMMAND
D:					
E:	G02114	m3/h			COP1 FLOW
F:	P02115	bar	L=0.0	H=20.0	COP1 DISCHARGE PRESS (before choke)
G:	P02116	bar			COP1 DISCHARGE PRESS (after choke)
H:	P02122	bar			COP1 SUCTION PRESSURE
I:					
J:	N02110	rpm	L=0.0	H=1950.0	COP1 SPEED
K:	N02101	rpm			COP1 SPEED COMMAND
L:	E02120	kW			COP1 POWER
M:	Z02121	%			COP1 HYDRAULIC EFFICIENCY
N:	Z02107	%	L=0.0	H=40.0	COP1 CAVITATION INDEX
O:					
P:	V02103	%			COP1 TURBINE STEAM CONTROL VALVE POS
Q:	Q02106	%			COP1 TURBINE SHAFT TORQUE
R:	G02104	m3/h			TURBINE STEAM FLOW COP1
S:	Z02105	kWh/kg			COP1 TURBINE EFFICIENCY
T:					

2.10 Page:0012 M** CARGO LINE 1 - PUMP BEARING/CONTROL

A:					
B:	P02241	bar	L=1.0	H=5.0	COP1 BEARING LO PRESSURE
C:	T02242	degC	L=0.0	H=60.0	COP1 BEARING TEMPERATURE
D:					
E:	V02111	%			COP1 RECIRCULATION VALVE POS
F:					
G:					
H:	R02240	<0-1>			COP1 LUB. OIL PUMP START
I:	R02246	<0-1>			COP1 START/STOP
J:	X02247	<0-5>	L=0.0	H=1.0	COP1 TRIP INDICATION
K:					
L:	R02133	<0-1>			COP1 SPEED SURGE CONTROL AUTO SWITCH
M:	R02134	<0-1>			COP1 FLOW SURGE CONTROL AUTO SWITCH
N:					
O:					
P:					
Q:	C02100	%/%			COP1 GOVERNOR GAIN CONSTANT
R:	C02266	-			COP1 GOVERNOR RESET TIME CONSTANT
S:					
T:					

2.11 Page:0013 M** CARGO LINE 1 - VACUUM SEPARATOR

A:					
B:	R02135	<0-1>			COP1 VACUUM PUMP START
C:	R02136	<0-1>			COP1 VACUUM PUMP AUTO SWITCH
D:					
E:	L02132	m	L=1.0	H=5.0	COP1 SEPARATOR LEVEL
F:	P02130	bar			COP1 SEPARATOR GAS PRESSURE (abs)
G:	G02127	m3/h			COP1 SEPARATOR INLET LIQUID FLOW
H:					
I:	G02125	m3/h			COP1 SEPARATOR GAS INFLUX
J:	G02126	m3/h			COP1 VACUUM PUMP GAS FLOW
K:					
L:	G02171	m3/h			FLOW FROM BOTTOM LINE 1
M:	G02172	m3/h			FLOW FROM CO SUCTION CROSSOVER
N:	G02170	m3/h			FLOW FROM SW SUCTION CROSSOVER
O:					
P:					
Q:	X02124	%			COP1 SEPARATOR OIL CONTENT
R:					
S:					
T:					

2.12 Page:0014 M** CARGO LINE 1 - BOTTOM PIPING

A:			
B:	G02171	m3/h	FLOW FROM BOTTOM LINE 1
C:	G02170	m3/h	FLOW FROM SW SUCTION CROSSOVER
D:	G02172	m3/h	FLOW FROM CO SUCTION CROSSOVER
E:			
F:	G02200	m3/h	TOTAL FLOW FROM WT-5-S
G:	G02201	m3/h	TOTAL FLOW FROM WT-5-P
H:	G02210	m3/h	TOTAL FLOW FROM CT-1
I:	G02211	m3/h	CROSS FLOW FROM BLIN2
J:			
K:	P02173	bar	PIPE LINE 1 PRESS (aft)
L:	T02174	degC	PIPE LINE 1 TEMP (aft)
M:	X02175	%	PIPE LINE 1 OIL CONTENT (aft)
N:			
O:	P02203	bar	PIPE LINE 1 PRESS (fore)
P:	T02204	degC	PIPE LINE 1 TEMP (fore)
Q:	X02205	%	PIPE LINE 1 OIL CONTENT (fore)
R:			
S:			
T:			

2.13 Page:0015 M** CARGO LINE 1 - DECK PIPING

A:			
B:	G02140	m3/h	FLOW FROM COP1 TO DECK LINE
C:	G02156	m3/h	FLOW FROM COP1 TO TC/COW CROSSOVER
D:	G02157	m3/h	FLOW FROM COP1 TO SLOP CROSSOVER
E:			
F:	G02141	m3/h	LOAD FLOW (to bottom line 1)
G:	G02143	m3/h	FLOW FROM SHORE TO MANIFOLD 1
H:			
I:	P02146	bar	DECK LINE 1 PRESSURE (aft)
J:	T02147	degC	DECK LINE 1 TEMPERATURE
K:	X02150	%	DECK LINE 1 OIL CONTENT (aft)
L:			
M:	P02151	bar	MANIFOLD 1 PRESSURE
N:	T02152	degC	MANIFOLD 1 TEMPERATURE
O:	X02153	%	MANIFOLD 1 OIL CONTENT
P:	D02154	kg/m3	MANIFOLD OIL DENSITY
Q:			
R:			
S:			
T:			

2.14 Page:0016 M** CARGO LINE 1 - PUMP MONITOR PAGE

A:			
B:			
C:	T03730	hour	TOTAL PUMP RUNNING TIME
D:	M03731	ktonn	TOTAL PUMP FLOW MASS
E:	E03732	MWh	TOTAL COP1 ENERGY
F:			
G:			
H:	M03733	tonn	TOTAL TURBINE STEAM MASS
I:	Z03734	US$	TOTAL STEAM COST
J:			
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.15 Page:0017 M** CARGO LINE 1 - PUMP DESIGN DATA

A:			
B:			
C:	C02260	-	COP1 PRESS CONSTANT 1
D:	C02261	-	COP1 PRESS CONSTANT 2
E:	C02262	-	COP1 PRESS CONSTANT 3
F:			
G:	C02263	-	COP1 TORQUE CONSTANT 1
H:	C02264	-	COP1 TORQUE CONSTANT 2
I:	C02265	-	COP1 TORQUE CONSTANT 3
J:			
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.16 Page:0020 M** CARGO LINE 2 - VALVES

A:			
B:	V12362	<0-1>	MANIFOLD 2 SHUT OFF VALVE (stbd)
C:	V12363	<0-1>	MANIFOLD 2 SHUT OFF VALVE (port)
D:			
E:	V02364	<0-1>	MANIFOLD 2 DRAIN VALVE
F:			
G:	V02425	%	DECK LINE 2 SHUT OFF VALVE
H:	V02426	<0-1>	LOAD LINE 2 SHUT OFF VALVE
I:			
J:			
K:	V02422	<0-1>	TC/COW CROSSOVER VALVE
L:	V02423	<0-1>	SLOP CROSSOVER VALVE
M:	V02420	<0-1>	CO SUCTION CROSSOVER VALVE
N:	V02421	<0-1>	SW SUCTION CROSSOVER VALVE
O:			
P:	V02424	<0-1>	BOTTOM LINE 2 SHUT OFF VALVE
Q:	V02427	<0-1>	BOTTOM LINE 2/3 CONNECTION VALVE
R:			
S:			
T:			

2.17 Page:0021 M** CARGO LINE 2 - PUMP/TURBINE

A:					
B:	V02312	%			COP2 DISCHARGE VALVE POS
C:	V02313	%			COP2 DISCHARGE VALVE POS COMMAND
D:					
E:	G02314	m3/h			COP2 FLOW
F:	P02315	bar	L=0.0	H=20.0	COP2 DISCHARGE PRESS (before choke)
G:	P02316	bar			COP2 DISCHARGE PRESS (after choke)
H:	P02322	bar			COP2 SUCTION PRESSURE
I:					
J:	N02310	rpm	L=0.0	H=1950.0	COP2 SPEED
K:	N02301	rpm			COP2 SPEED COMMAND
L:	E02320	kW			COP2 POWER
M:	Z02321	%			COP2 HYDRAULIC EFFICIENCY
N:	Z02307	%	L=0.0	H=40.0	COP2 CAVITATION INDEX
O:					
P:	V02303	%			COP2 TURBINE STEAM CONTROL VALVE POS
Q:	Q02306	%			COP2 TURBINE SHAFT TORQUE
R:	G02304	m3/h			TURBINE STEAM FLOW COP2
S:	Z02305	kWh/kg			COP2 TURBINE EFFICIENCY
T:					

2.18 Page:0022 M** CARGO LINE 2 - PUMP BEARING/CONTROL

A:					
B:	P02441	bar	L=1.0	H=5.0	COP2 BEARING LO PRESSURE
C:	T02442	degC	L=0.0	H=70.0	COP2 BEARING TEMPERATURE
D:					
E:	V02311	%			COP2 RECIRCULATION VALVE POS
F:					
G:					
H:	R02440	<0-1>			COP2 LUB. OIL PUMP START
I:	R02446	<0-1>			COP2 START/STOP
J:	X02447	<0-5>	L=0.0	H=1.0	COP2 TRIP INDICATION
K:					
L:	R02333	<0-1>			COP2 SPEED SURGE CONTROL AUTO SWITCH
M:	R02334	<0-1>			COP2 FLOW SURGE CONTROL AUTO SWITCH
N:					
O:					
P:					
Q:	C02300	%/%			COP2 GOVERNOR GAIN CONSTANT
R:	C02466	-			COP2 GOVERNOR RESET TIME CONSTANT
S:					
T:					

2.19 Page:0023 M** CARGO LINE 2 - VACUUM SEPARATOR

A:					
B:	R02335	<0-1>			COP2 VACUUM PUMP START
C:	R02336	<0-1>			COP2 VACUUM PUMP AUTO SWITCH
D:					
E:	L02332	m	L=1.0	H=5.0	COP2 SEPARATOR LEVEL
F:	P02330	bar			COP2 SEPARATOR GAS PRESSURE (abs)
G:	G02327	m3/h			COP2 SEPARATOR INLET LIQUID FLOW
H:					
I:	G02325	m3/h			COP2 SEPARATOR GAS INFLUX
J:	G02326	m3/h			COP2 VACUUM PUMP GAS FLOW
K:					
L:	G02371	m3/h			FLOW FROM BOTTOM LINE 2
M:	G02372	m3/h			FLOW FROM CO SUCTION CROSSOVER
N:	G02370	m3/h			FLOW FROM SW SUCTION CROSSOVER
O:					
P:					
Q:	X02324	%			COP2 SEPARATOR OIL CONTENT
R:					
S:					
T:					

2.20 Page:0024 M** CARGO LINE 2 - BOTTOM PIPING

A:			
B:	G02371	m3/h	FLOW FROM BOTTOM LINE 2
C:	G02370	m3/h	FLOW FROM SW SUCTION CROSSOVER
D:	G02372	m3/h	FLOW FROM CO SUCTION CROSSOVER
E:			
F:	G02400	m3/h	TOTAL FLOW FROM TANK WT-1-S
G:	G02401	m3/h	TOTAL FLOW FROM TANK WT-1-P
H:	G02410	m3/h	TOTAL FLOW FROM TANK CT-4
I:	G02411	m3/h	CROSS FLOW FROM BLIN3
J:			
K:	P02373	bar	PIPE LINE 2 PRESS (aft)
L:	T02374	degC	PIPE LINE 2 TEMP (aft)
M:	X02375	%	PIPE LINE 2 OIL CONTENT (aft)
N:			
O:	P02403	bar	PIPE LINE 2 PRESS (fore)
P:	T02404	degC	PIPE LINE 2 TEMP (fore)
Q:	X02405	%	PIPE LINE 2 OIL CONTENT (fore)
R:			
S:			
T:			

2.21 Page:0025 M** CARGO LINE 2 - DECK PIPING

A:			
B:	G02340	m3/h	FLOW FROM COP2 TO DECK LINE
C:	G02356	m3/h	FLOW FROM COP2 TO TC/COW CROSSOVER
D:	G02357	m3/h	FLOW FROM COP2 TO SLOP CROSSOVER
E:			
F:	G02341	m3/h	LOAD FLOW (to bottom line 2)
G:	G02343	m3/h	FLOW FROM SHORE TO MANIFOLD 2
H:			
I:	P02346	bar	DECK LINE 2 PRESSURE (aft)
J:	T02347	degC	DECK LINE 2 TEMPERATURE
K:	X02350	%	DECK LINE 2 OIL CONTENT (aft)
L:			
M:	P02351	bar	MANIFOLD 2 PRESSURE
N:	T02352	degC	MANIFOLD 2 TEMPERATURE
O:	X02353	%	MANIFOLD 2 OIL CONTENT
P:	D02354	kg/m3	MANIFOLD OIL DENSITY
Q:			
R:			
S:			
T:			

2.22 Page:0026 M** CARGO LINE 2 - PUMP MONITOR PAGE

A:			
B:			
C:	T03740	hour	TOTAL PUMP RUNNING TIME
D:	M03741	ktonn	TOTAL PUMP FLOW MASS
E:	E03742	MWh	TOTAL COP2 ENERGY
F:			
G:			
H:	M03743	tonn	TOTAL TURBINE STEAM MASS
I:	Z03744	US$	TOTAL STEAM COST
J:			
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.23 Page:0027 M** CARGO LINE 2 - PUMP DESIGN DATA

A:			
B:			
C:	C02460	-	COP2 PRESS CONSTANT 1
D:	C02461	-	COP2 PRESS CONSTANT 2
E:	C02462	-	COP2 PRESS CONSTANT 3
F:			
G:	C02463	-	COP2 TORQUE CONSTANT 1
H:	C02464	-	COP2 TORQUE CONSTANT 2
I:	C02465	-	COP2 TORQUE CONSTANT 3
J:			
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.24 Page:0030 M** CARGO LINE 3 - VALVES

A:	V12562	<0-1>	MANIFOLD 3 SHUT OFF VALVE (stbd)
B:	V12563	<0-1>	MANIFOLD 3 SHUT OFF VALVE (port)
C:			
D:	V02566	<0-1>	MANIF 3/4 CROSSOVER VALVE
E:	V02564	<0-1>	MANIFOLD 3 DRAIN VALVE
F:			
G:	V02625	%	DECK LINE 3 SHUT OFF VALVE
H:	V02626	<0-1>	LOAD LINE 3 SHUT OFF VALVE
I:			
J:	V02622	<0-1>	TC/COW CROSSOVER VALVE
K:	V02623	<0-1>	SLOP CROSSOVER VALVE
L:	V02620	<0-1>	CO SUCTION CROSSOVER VALVE
M:	V02621	<0-1>	SW SUCTION CROSSOVER VALVE
N:			
O:	V02624	<0-1>	BOTTOM LINE 3 SHUT OFF VALVE
P:	V02627	<0-1>	BOTTOM LINE 3/4 CONNECTION VALVE
Q:	V02628	<0-1>	BOTTOM LINE 3/4 CONNECTION VALVE
R:	V02630	<0-1>	FORE BOTTOM LINE 3 ISOLATION VALVE
S:	V02631	<0-1>	LOAD LINE 3/ CT-3 ISOLATION VALVE
T:	V02638	<0-1>	LOAD LINE 3/ CT-3 ISOLATION VALVE

2.25 Page:0031 M** CARGO LINE 3 - PUMP/TURBINE

A:					
B:	V02512	%			COP3 DISCHARGE VALVE POS
C:	V02513	%			COP3 DISCHARGE VALVE POS COMMAND
D:					
E:	G02514	m3/h			COP3 FLOW
F:	P02515	bar	L=0.0	H=20.0	COP3 DISCHARGE PRESS (before choke)
G:	P02516	bar			COP3 DISCHARGE PRESS (after choke)
H:	P02522	bar			COP3 SUCTION PRESSURE
I:					
J:	N02510	rpm	L=0.0	H=1950.0	COP3 SPEED
K:	N02501	rpm			COP3 SPEED COMMAND
L:	E02520	kW			COP3 POWER
M:	Z02521	%			COP3 HYDRAULIC EFFICIENCY
N:	Z02507	%	L=0.0	H=40.0	COP3 CAVITATION INDEX
O:					
P:	V02503	%			COP3 TURBINE STEAM CONTROL VALVE POS
Q:	Q02506	%			COP3 TURBINE SHAFT TORQUE
R:	G02504	m3/h			TURBINE STEAM FLOW COP3
S:	Z02505	kWh/kg			COP3 TURBINE EFFICIENCY
T:					

2.26 Page:0032 M** CARGO LINE 3 - PUMP BEARING/CONTROL

A:					
B:	P02641	bar	L=1.0	H=5.0	COP3 BEARING LO PRESSURE
C:	T02642	degC	L=0.0	H=70.0	COP3 BEARING TEMPERATURE
D:					
E:	V02511	%			COP3 RECIRCULATION VALVE POS
F:					
G:					
H:	R02640	<0-1>			COP3 LUB. OIL PUMP START
I:	R02646	<0-1>			COP3 START/STOP
J:	X02647	<0-5>	L=0.0	H=1.0	COP3 TRIP INDICATION
K:					
L:	R02533	<0-1>			COP3 SPEED SURGE CONTROL AUTO SWITCH
M:	R02534	<0-1>			COP3 FLOW SURGE CONTROL AUTO SWITCH
N:					
O:					
P:					
Q:	C02500	%/%			COP3 GOVERNOR GAIN CONSTANT
R:	C02666	-			COP3 GOVERNOR RESET TIME CONSTANT
S:					
T:					

2.27 Page:0033 M** CARGO LINE 3 - VACUUM SEPARATOR

A:					
B:	R02535	<0-1>			COP3 VACUUM PUMP START
C:	R02536	<0-1>			COP3 VACUUM PUMP AUTO SWITCH
D:					
E:	L02532	m	L=1.0	H=5.0	COP3 SEPARATOR LEVEL
F:	P02530	bar			COP3 SEPARATOR GAS PRESSURE (abs)
G:	G02527	m3/h			COP3 SEPARATOR INLET LIQUID FLOW
H:					
I:	G02525	m3/h			COP3 SEPARATOR GAS INFLUX
J:	G02526	m3/h			COP3 VACUUM PUMP GAS FLOW
K:					
L:	G02571	m3/h			FLOW FROM BOTTOM LINE 3
M:	G02572	m3/h			FLOW FROM CO SUCTION CROSSOVER
N:	G02570	m3/h			FLOW FROM SW SUCTION CROSSOVER
O:					
P:					
Q:	X02524	%			COP3 SEPARATOR OIL CONTENT
R:					
S:					
T:					

2.28 Page:0034 M** CARGO LINE 3 - BOTTOM PIPING

A:				
B:	G02571	m3/h	FLOW FROM BOTTOM LINE 3	
C:	G02570	m3/h	FLOW FROM SW SUCTION CROSSOVER	
D:	G02572	m3/h	FLOW FROM CO SUCTION CROSSOVER	
E:				
F:	G02600	m3/h	TOTAL FLOW FROM TANK WT-2-S	
G:	G02601	m3/h	TOTAL FLOW FROM TANK WT-2-P	
H:	G02610	m3/h	FLOW FROM TANK CT-3 / LOAD LINE 3	
I:	G02611	m3/h	CROSS FLOW FROM BLIN4	
J:	G02602	m3/h	FLOW FROM FORE TANKS	
K:	G02565	m3/h	FLOW FROM SLOP TANKS	
L:				
M:	P02573	bar	PIPE LINE 3 PRESS	(aft)
N:	T02574	degC	PIPE LINE 2 TEMP	(aft)
O:	X02575	%	PIPE LINE 3 OIL CONTENT	(aft)
P:				
Q:	P02603	bar	PIPE LINE 3 PRESS	(fore)
R:	T02604	degC	PIPE LINE 2 TEMP	(fore)
S:	X02605	%	PIPE LINE 3 OIL CONTENT	(fore)
T:				

2.29 Page:0035 M** CARGO LINE 3 - DECK PIPING

A:			
B:	G02540	m3/h	FLOW FROM COP3 TO DECK LINE
C:	G02556	m3/h	FLOW FROM COP3 TO TC/COW CROSSOVER
D:	G02557	m3/h	FLOW FROM COP3 TO SLOP CROSSOVER
E:			
F:	G02541	m3/h	LOAD FLOW (to bottom line 3)
G:	G02543	m3/h	FLOW FROM SHORE TO MANIFOLD 3
H:			
I:	P02546	bar	DECK LINE 3 PRESSURE (aft)
J:	T02547	degC	DECK LINE 2 TEMPERATURE
K:	X02550	%	DECK LINE 3 OIL CONTENT (aft)
L:			
M:	P02551	bar	MANIFOLD 3 PRESSURE
N:	T02552	degC	MANIFOLD 2 TEMPERATURE
O:	X02553	%	MANIFOLD 3 OIL CONTENT
P:	D02554	kg/m3	MANIFOLD OIL DENSITY
Q:			
R:			
S:			
T:			

2.30 Page:0036 M** CARGO LINE 3 - PUMP MONITOR PAGE

A:			
B:			
C:	T03750	hour	TOTAL PUMP RUNNING TIME
D:	M03751	ktonn	TOTAL PUMP FLOW MASS
E:	E03752	MWh	TOTAL COP3 ENERGY
F:			
G:			
H:	M03753	tonn	TOTAL TURBINE STEAM MASS
I:	Z03754	US$	TOTAL STEAM COST
J:			
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.31 Page:0037 M** CARGO LINE 3 - PUMP DESIGN DATA

A:			
B:			
C:	C02660	-	COP3 PRESS CONSTANT 1
D:	C02661	-	COP3 PRESS CONSTANT 2
E:	C02662	-	COP3 PRESS CONSTANT 3
F:			
G:	C02663	-	COP3 TORQUE CONSTANT 1
H:	C02664	-	COP3 TORQUE CONSTANT 2
I:	C02665	-	COP3 TORQUE CONSTANT 3
J:			
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.32 Page:0040 M** CARGO LINE 4 - VALVES

A:			
B:	V12762	<0-1>	MANIFOLD 4 SHUT OFF VALVE (stbd)
C:	V12763	<0-1>	MANIFOLD 4 SHUT OFF VALVE (port)
D:			
E:	V02764	<0-1>	MANIFOLD 4 DRAIN VALVE
F:			
G:	V03025	%	DECK LINE 4 SHUT OFF VALVE
H:	V03026	<0-1>	LOAD LINE 4 SHUT OFF VALVE
I:			
J:			
K:	V03022	<0-1>	TC/COW CROSSOVER VALVE
L:	V03023	<0-1>	SLOP CROSSOVER VALVE
M:	V03020	<0-1>	CO SUCTION CROSSOVER VALVE
N:	V03021	<0-1>	SW SUCTION CROSSOVER VALVE
O:			
P:	V03024	<0-1>	BOTTOM LINE 4 SHUT OFF VALVE
Q:			
R:			
S:			
T:			

2.33 Page:0041 M** CARGO LINE 4 - PUMP/TURBINE

A:					
B:	V02712	%			COP4 DISCHARGE VALVE POS
C:	V02713	%			COP4 DISCHARGE VALVE POS COMMAND
D:					
E:	G02714	m3/h			COP4 FLOW
F:	P02715	bar	L=0.0	H=20.0	COP4 DISCHARGE PRESS (before choke)
G:	P02716	bar			COP4 DISCHARGE PRESS (after choke)
H:	P02722	bar			COP4 SUCTION PRESSURE
I:					
J:	N02710	rpm	L=0.0	H=1950.0	COP4 SPEED
K:	N02701	rpm			COP4 SPEED COMMAND
L:	E02720	kW			COP4 POWER
M:	Z02721	%			COP4 HYDRAULIC EFFICIENCY
N:	Z02707	%	L=0.0	H=40.0	COP4 CAVITATION INDEX
O:					
P:	V02703	%			COP4 TURBINE STEAM CONTROL VALVE POS
Q:	Q02706	%			COP4 TURBINE SHAFT TORQUE
R:	G02704	m3/h			TURBINE STEAM FLOW COP4
S:	Z02705	kWh/kg			COP4 TURBINE EFFICIENCY
T:					

2.34 Page:0042 M** CARGO LINE 4 - PUMP BEARING/CONTROL

A:					
B:	P03041	bar	L=1.0	H=5.0	COP4 BEARING LO PRESSURE
C:	T03042	degC	L=0.0	H=70.0	COP4 BEARING TEMPERATURE
D:					
E:	V02711	%			COP4 RECIRCULATION VALVE POS
F:					
G:					
H:	R03040	<0-1>			COP4 LUB. OIL PUMP START
I:	R03046	<0-1>			COP4 START/STOP
J:	X03047	<0-5>	L=0.0	H=1.0	COP4 TRIP INDICATION
K:					
L:	R02733	<0-1>			COP4 SPEED SURGE CONTROL AUTO SWITCH
M:	R02734	<0-1>			COP4 FLOW SURGE CONTROL AUTO SWITCH
N:					
O:					
P:					
Q:	C02700	%/%			COP4 GOVERNOR GAIN CONSTANT
R:	C03066	-			COP4 GOVERNOR RESET TIME CONSTANT
S:					
T:					

2.35 Page:0043 M** CARGO LINE 4 - VACUUM SEPARATOR

A:					
B:	R02735	<0-1>			COP4 VACUUM PUMP START
C:	R02736	<0-1>			COP4 VACUUM PUMP AUTO SWITCH
D:					
E:	L02732	m	L=1.0	H=5.0	COP4 SEPARATOR LEVEL
F:	P02730	bar			COP4 SEPARATOR GAS PRESSURE (abs)
G:	G02727	m3/h			COP4 SEPARATOR INLET LIQUID FLOW
H:					
I:	G02725	m3/h			COP4 SEPARATOR GAS INFLUX
J:	G02726	m3/h			COP4 VACUUM PUMP GAS FLOW
K:					
L:	G02771	m3/h			FLOW FROM BOTTOM LINE 4
M:	G02772	m3/h			FLOW FROM CO SUCTION CROSSOVER
N:	G02770	m3/h			FLOW FROM SW SUCTION CROSSOVER
O:					
P:					
Q:	X02724	%			COP4 SEPARATOR OIL CONTENT
R:					
S:					
T:					

2.36 Page:0044 M** CARGO LINE 4 - BOTTOM PIPING

A:				
B:	G02771	m3/h	FLOW FROM BOTTOM LINE 4	
C:	G02770	m3/h	FLOW FROM SW SUCTION CROSSOVER	
D:	G02772	m3/h	FLOW FROM CO SUCTION CROSSOVER	
E:				
F:	G03000	m3/h	TOTAL FLOW FROM TANK WT-4-S	
G:	G03001	m3/h	TOTAL FLOW FROM TANK WT-4-P	
H:	G03010	m3/h	TOTAL FLOW FROM TANK CT-2	
I:				
J:				
K:	P02773	bar	PIPE LINE 4 PRESS	(aft)
L:	T02774	degC	PIPE LINE 4 TEMP	(aft)
M:	X02775	%	PIPE LINE 4 OIL CONTENT	(aft)
N:				
O:	P03003	bar	PIPE LINE 4 PRESS	(fore)
P:	T03004	degC	PIPE LINE 4 TEMP	(fore)
Q:	X03005	%	PIPE LINE 4 OIL CONTENT	(fore)
R:				
S:				
T:				

2.37 Page:0045 M** CARGO LINE 4 - DECK PIPING

A:			
B:	G02740	m3/h	FLOW FROM COP4 TO DECK LINE
C:	G02756	m3/h	FLOW FROM COP4 TO TC/COW CROSSOVER
D:	G02757	m3/h	FLOW FROM COP4 TO SLOP CROSSOVER
E:			
F:	G02741	m3/h	LOAD FLOW (to bottom line 4)
G:	G02743	m3/h	FLOW FROM SHORE TO MANIFOLD 4
H:			
I:	P02746	bar	DECK LINE 4 PRESSURE (aft)
J:	T02747	degC	DECK LINE 4 TEMPERATURE
K:	X02750	%	DECK LINE 4 OIL CONTENT (aft)
L:			
M:	P02751	bar	MANIFOLD 4 PRESSURE
N:	T02752	degC	MANIFOLD 4 TEMPERATURE
O:	X02753	%	MANIFOLD 4 OIL CONTENT
P:	D02754	kg/m3	MANIFOLD OIL DENSITY
Q:			
R:			
S:			
T:			

2.38 Page:0046 M** CARGO LINE 4 - PUMP MONITOR PAGE

A:			
B:			
C:	T03760	hour	TOTAL PUMP RUNNING TIME
D:	M03761	ktonn	TOTAL PUMP FLOW MASS
E:	E03762	MWh	TOTAL COP4 ENERGY
F:			
G:			
H:	M03763	tonn	TOTAL TURBINE STEAM MASS
I:	Z03764	US$	TOTAL STEAM COST
J:			
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.39 Page:0047 M** CARGO LINE 4 - PUMP DESIGN DATA

A:			
B:			
C:	C03060	-	COP4 PRESS CONSTANT 1
D:	C03061	-	COP4 PRESS CONSTANT 2
E:	C03062	-	COP4 PRESS CONSTANT 3
F:			
G:	C03063	-	COP4 TORQUE CONSTANT 1
H:	C03064	-	COP4 TORQUE CONSTANT 2
I:	C03065	-	COP4 TORQUE CONSTANT 3
J:			
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.40 Page:0050 M** BALLAST WATER LINE - VALVES

A:			
B:	V03220	<0-1>	BW SEA CHEST SHUT OFF VALVE
C:			
D:	V03221	<0-1>	BW SEA CHEST LINE SUCTION VALVE
E:	V03223	<0-1>	BW SEA CHEST LINE DISCHARGE VALVE
F:			
G:	V03222	<0-1>	BW BOTTOM LINE SUCTION VALVE
H:	V03224	<0-1>	BW BOTTOM LINE DISCHARGE VALVE
I:			
J:	V03225	<0-1>	BW DECK LINE SHUT OFF VALVE
K:			
L:			
M:	V03270	<0-1>	BW DROP LINE VALVE (CT2)
N:	V03271	<0-1>	BW DROP LINE VALVE (WT2S)
O:	V03272	<0-1>	BW DROP LINE VALVE (WT2P)
P:			
Q:	V03273	<0-1>	BW DROP LINE VALVE (CT4)
R:	V03274	<0-1>	BW DROP LINE VALVE (WT5S)
S:	V03275	<0-1>	BW DROP LINE VALVE (WT5P)
T:			

2.41 Page:0051 M** BALLAST WATER LINE - PUMP/TURBINE

A:					
B:	V03112	%			BWP DISCHARGE VALVE POS
C:	V03113	%			BWP DISCHARGE VALVE POS COMMAND
D:					
E:	G03114	m3/h			BWP FLOW
F:	P03115	bar	L=0.0	H=20.0	BWP DISCHARGE PRESS (before choke)
G:	P03116	bar			BWP DISCHARGE PRESS (after choke)
H:	P03122	bar			BWP SUCTION PRESSURE
I:					
J:	N03110	rpm	L=0.0	H=1950.0	BWP SPEED
K:	N03101	rpm			BWP SPEED COMMAND
L:	E03120	kW			BWP POWER
M:	Z03121	%			BWP HYDRAULIC EFFICIENCY
N:	Z03107	%	L=0.0	H=40.0	BWP CAVITATION INDEX
O:					
P:	V03103	%			BWP TURBINE STEAM CONTROL VALVE POS
Q:	Q03106	%			BWP TURBINE SHAFT TORQUE
R:	G03104	m3/h			TURBINE STEAM FLOW BWP
S:	Z03105	kWh/kg			BWP TURBINE EFFICIENCY
T:					

2.42 Page:0052 M** BALLAST WATER LINE - PUMP BEARING/CONTROL

A:					
B:	P03241	bar	L=1.0	H=5.0	BWP BEARING LO PRESSURE
C:	T03242	degC	L=0.0	H=70.0	BWP BEARING TEMPERATURE
D:					
E:	V03111	%			BWP RECIRCULATION VALVE POS
F:					
G:					
H:	R03240	<0-1>			BWP LUB. OIL PUMP START
I:	R03246	<0-1>			BWP START/STOP
J:	X03247	<0-5>	L=0.0	H=1.0	BWP TRIP INDICATION
K:					
L:					
M:					
N:					
O:	C03100	%/%			BWP GOVERNOR GAIN CONSTANT
P:	C03256	-			BWP GOVERNOR RESET TIME CONSTANT
Q:					
R:					
S:					
T:					

2.43 Page:0053 M** BALLAST WATER LINE - FLOWS

A:	G03200	m3/h	FLOW FROM FPEAK TANK
B:	G03201	m3/h	FLOW FROM TANK WT-3-S
C:	G03202	m3/h	FLOW FROM TANK WT-3-P
D:			
E:	G03170	m3/h	BW SEA CHEST INLET FLOW
F:	G03171	m3/h	SUCTION FLOW FROM BW SEA CHEST LINE
G:	G03172	m3/h	SUCTION FLOW FROM BW BOTTOM LINE
H:			
I:	G03161	m3/h	DISCHARGE FLOW TO BW SEA CHEST LINE
J:	G03160	m3/h	DISCHARGE FLOW TO BW BOTTOM LINE
K:	G03162	m3/h	DISCHARGE FLOW TO BW DECK LINE
L:			
M:	G03260	m3/h	BW DROP FLOW INTO TANK (CT2)
N:	G03261	m3/h	BW DROP FLOW INTO TANK (WT2S)
O:	G03262	m3/h	BW DROP FLOW INTO TANK (WT2P)
P:			
Q:	G03263	m3/h	BW DROP FLOW INTO TANK (CT4)
R:	G03264	m3/h	BW DROP FLOW INTO TANK (WT5S)
S:	G03265	m3/h	BW DROP FLOW INTO TANK (WT5P)
T:			

2.44 Page:0054 M** BALLAST WATER LINE - PRESSURES

A:			
B:			
C:	P04010	bar	STATIC SW PRESSURE (aft)
D:			
E:	P03124	bar	BW SEA CHEST PRESSURE
F:	P03173	bar	BW BOTTOM LINE PRESSURE (aft)
G:			
H:	P03122	bar	BWP SUCTION PRESSURE
I:	P03116	bar	BWP DISCHARGE PRESS (after choke)
J:			
K:	P03146	bar	BW DECK LINE PRESSURE
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.45 Page:0056 M** BALLAST WATER LINE - PUMP MONITOR PAGE

A:			
B:			
C:	T03770	hour	TOTAL PUMP RUNNING TIME
D:	M03771	ktonn	TOTAL PUMP FLOW MASS
E:	E03772	MWh	TOTAL BWP ENERGY
F:			
G:			
H:	M03773	tonn	TOTAL TURBINE STEAM MASS
I:	Z03774	US$	TOTAL STEAM COST
J:			
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.46 Page:0057 M** BALLAST WATER LINE - PUMP DESIGN DATA

A:			
B:			
C:	C03250	-	BWP PRESS CONSTANT 1
D:	C03251	-	BWP PRESS CONSTANT 2
E:	C03252	-	BWP PRESS CONSTANT 3
F:			
G:	C03253	-	BWP TORQUE CONSTANT 1
H:	C03254	-	BWP TORQUE CONSTANT 2
I:	C03255	-	BWP TORQUE CONSTANT 3
J:			
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.47 Page:0060 M** CROSS-OVER LINES

A:			
B:	P03350	bar	CO SUCTION CROSSOVER PRESSURE
C:	P03351	bar	SW SUCTION PORT CROSSOVER PRESSURE
D:	P03352	bar	TC/COW CROSSOVER PRESSURE
E:	P03353	bar	SLOP CROSSOVER PRESSURE
F:	P03358	bar	SW SUCTION STBD CROSSOVER PRESSURE
G:			
H:	X03354	%	CO SUCTION CROSSOVER OIL CONTENT
I:	X03355	%	SW SUCTION PORT CROSSOVER OIL CONTENT
J:	X03356	%	TC/COW CROSSOVER OIL CONTENT
K:	X03357	%	SLOP CROSSOVER OIL CONTENT
L:	X03359	%	SW SUCTION STBD CROSSOVER OIL CONTENT
M:			
N:			
O:	V03365	<0-1>	SWSC SEA CHEST VALVE (port)
P:	V03369	<0-1>	SWSC SEA CHEST VALVE (port)
Q:	V03367	<0-1>	SW SUCTION SEPARATION VALVE
R:	V03368	<0-1>	SWSC SEA CHEST VALVE (stbd)
S:	V03364	<0-1>	SWSC SEA CHEST VALVE (stbd)
T:			

2.48 Page:0061 M** STRIPPING PUMP

A:			
B:	N03300	spm	STRIPPING PUMP SPEED COMMAND
C:	N03301	spm	STRIPPING PUMP SPEED
D:	G03304	m3/h	STRIPPING PUMP FLOW
E:			
F:	P03310	bar	STRIPPING PUMP DISCHARGE PRESS
G:	P03350	bar	CO SUCTION CROSSOVER PRESSURE
H:			
I:	V03324	<0-1>	STRIPPING PUMP SUCTION VALVE
J:	V03325	<0-1>	STRIPPING PUMP DISCHARGE VALVE
K:			
L:	G03303	m3/h	STRIPPING PUMP STEAM FLOW
M:	V03302	%	STRIPPING PUMP STEAM CONTROL VALVE
N:	V03326	<0-1>	STRIPPING PUMP STEAM SUPPLY VALVE
O:			
P:			
Q:	V03323	<0-1>	SLOP CROSSOVER VALVE
R:	G03306	m3/h	FLOW TO SLOP CROSSOVER
S:			
T:			

2.49 Page:0062 M** EDUCTOR

A:			
B:	G03340	m3/h	EDUCTOR DRIVE FLOW
C:	G03341	m3/h	EDUCTOR SUCTION FLOW
D:	G03345	m3/h	EDUCTOR DISCHARGE FLOW
E:			
F:	V03342	%	EDUCTOR DRIVE VALVE
G:	V03343	<0-1>	EDUCTOR SUCTION VALVE
H:			
I:	P03346	bar	EDUCTOR DRIVE PRESSURE
J:	P03352	bar	TC/COW CROSSOVER PRESSURE
K:	P03350	bar	CO SUCTION CROSSOVER PRESSURE
L:			
M:	X03344	%	EDUCTOR DISCHARGE FLOW OIL CONTENT
N:	X03356	%	TC/COW CROSSOVER OIL CONTENT
O:	X03354	%	CO SUCTION CROSSOVER OIL CONTENT
P:			
Q:	V03322	<0-1>	TCOWC/COSC CONNECTION VALVE
R:	G03305	m3/h	FLOW FROM TCOWC TO COSC
S:			
T:			

2.50 Page:0064 M** OIL DISCHARGE MONITOR/SLOPC

A:	R03610	<0-1>			OIL DISCHARGE MONITOR AUTO SWITCH
B:	Z03605	<0-1>			OIL DISCHARGE MONITOR RESET COMMAND
C:					
D:	V03611	<0-1>			OVERBOARD AUTO VALVE
E:	V03612	<0-1>			RECIRC-TO-SLOPT AUTO VALVE
F:	V03375	<0-1>			OVERBOARD VALVE (high discharge)
G:	V03374	<0-1>			SLOPT(P) DIRTY BALLAST INLET VALVE
H:					
I:	P03353	bar			SLOP CROSSOVER PRESSURE
J:	G03372	m3/h			FLOW OVERBOARD (high discharge)
K:	G03371	m3/h			DIRTY BALLAST DISCHARGE TO SLOPT(P)
L:	G03370	m3/h			FLOW FROM SLOPC TO ODM
M:	X03473	ppm			SLOP CROSSOVER OIL CONTENT
N:					
O:	X03600	ppm	L=0.0	H=15.0	OVERBOARD OIL CONTENT
P:	M03603	kg			TOTAL OVER BOARD DISCHARGED OIL MASS
Q:	M03604	kg/Nm	L=0.0	H=20.0	SPECIFIC OIL DISCHARGE
R:					
S:	X03601	ppm			RECIRC OIL CONTENT LIMIT
T:					

2.51 Page:0065 M** SMALL DIAMETER LINE

A:			
B:			
C:	V03320	<0-1>	SMALL DIAM LINE MANIF VALVE (S)
D:	V03321	<0-1>	SMALL DIAM LINE MANIF VALVE (P)
E:			
F:			
G:	G03307	m3/h	SMALL DIAM LINE FLOW
H:	P03311	bar	SMALL DIAM LINE PRESSURE (deck)
I:			
J:	X03312	%	SMALL DIAM LINE OIL CONTENT
K:			
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.52 Page:0070 M** TANK CLEANING/CRUDE OIL WASHING

A:			
B:	V03403	%	MAIN COW SUPPLY VALVE
C:	P03400	bar	MAIN COW LINE PRESSURE
D:	G03402	m3/h	MAIN COW LINE FLOW
E:			
F:			
G:			
H:			
I:			
J:			
K:			
L:			
M:			
N:			
O:			
P:	X03401	%	OIL CONCENTRATION IN TC/COW FLOW
Q:			
R:			
S:			
T:			

2.53 Page:0071 M** SLOP DECANTING SYSTEM

A:			
B:	V03452	%	BALANCE LINE VALVE
C:	G03450	m3/h	BALANCE FLOW FROM PORT TO STBD SLOPT
D:	X03451	%	BALANCE LINE OIL CONTENT
E:			
F:	L03453	m	BALANCE LINE OUTLET HEIGHT (stbd)
G:	L03454	m	BALANCE LINE OUTLET HEIGHT (port)
H:			
I:			
J:			
K:	V03462	%	EQUALIZING LINE VALVE
L:	V03468	<0-1>	EQUALIZING LINE SHUT OFF VALVE
M:	G03460	m3/h	EQUALIZING FLOW FROM SLOPT(P) TO CT4
N:	X03461	%	EQUALIZING LINE OIL CONTENT
O:			
P:	L03463	m	EQUALIZING LINE OUTLET HEIGHT (SLOP P)
Q:	L03464	m	EQUALIZING LINE OUTLET HEIGHT (CT4)
R:			
S:			
T:			

2.54 Page:0073 M** HFO TRANSFER SYSTEM

A:			
B:	R04103	<0-1>	HFO TRANSFER PUMP START
C:	V04104	<0-1>	HFO TRANSFER SELECT (1=fore to aft)
D:	G04100	m3/h	HFO TRANSFER FLOW (fore to aft)
E:			
F:	G04102	m3/h	MAIN ENGINE FUEL OIL CONSUMPTION
G:	G04101	m3/h	STEAM BOILER FUEL OIL CONSUMPTION
H:	V04002	knots	SHIP SPEED
I:			
J:	V04110	%	FORE HFO TANK VOLUME
K:	M04111	tonn	FORE HFO TANK MASS
L:	L04112	m	FORE HFO TANK SOUNDING
M:	L04113	m	FORE HFO TANK ULLAGE
N:			
O:	V04120	%	AFT HFO TANK VOLUME
P:	M04121	tonn	AFT HFO TANK MASS
Q:	L04122	m	AFT HFO TANK SOUNDING
R:	L04123	m	AFT HFO TANK ULLAGE
S:			
T:			

2.55 Page:0074 M** MISCELLANEOUS TANKS

A:		
B: V04130	%	HFO SETTLING TANK VOLUME
C: V04131	%	HFO SERVICE TANK VOLUME
D: V04132	%	DO STORAGE TANK VOLUME
E: V04133	%	DO SETTLING TANK VOLUME
F: V04134	%	DO SERVICE TANK VOLUME
G: V04135	%	FRESH WATER TANK VOLUME
H:		
I: M04140	tonn	HFO SETTLING TANK MASS
J: M04141	tonn	HFO SERVICE TANK MASS
K: M04142	tonn	DO STORAGE TANK MASS
L: M04143	tonn	DO SETTLING TANK MASS
M: M04144	tonn	DO SERVICE TANK MASS
N: M04145	tonn	FRESH WATER TANK MASS
O:		
P:		
Q:		
R:		
S:		
T:		

2.56 Page:0080 M** STEAM BOILER - MAIN VARIABLES

A: R03514	<0-1>	BOILER START COMMAND
B: Z03515	<0-2>	STATE (0,1,2)=(off,on,up/down)
C:		
D: P03500	bar	DRUM STEAM PRESSURE
E: P03501	bar	SUPERHEATED STEAM PRESSURE
F: T03502	degC	SUPERHEATED STEAM TEMP
G:		
H: G03506	m3/h	BOILER STEAM FLOW
I: G03503	m3/h	BOILER OIL FLOW
J: X03504	%	BOILER FLUE GAS OXYGEN CONTENT
K: Z03505	%	BOILER EFFICIENCY
L:		
M: V03523	%	FO CONTROL VALVE POS
N:		
O:		
P: G03507	m3/h	STEAM FLOW TO PUMPS
Q: G03510	m3/h	STEAM FLOW TO TANK HEATING
R:		
S:		
T: P03530	bar	STEAM CONDENSER PRESSURE (abs)

2.57 Page:0081 M** STEAM BOILER - CONTROL DATA

A:			
B:	Z03513	<0-1>	BOILER ISOLATION
C:			
D:	P03511	bar	STEAM PRESS TO CARGO PUMPS AT ISOLA
E:	T03512	degC	STEAM TEMP TO CARGO PUMPS AT ISOLA
F:			
G:	V03517	%	BOILER STEAM LOAD VALVE AT ISOLA
H:	X03526	%	BOILER FLUE GAS OXY CONTENT AT ISOLA
I:			
J:	P03520	bar	BOILER STEAM PRESSURE SET POINT
K:			
L:	C03521	%/bar	BOILER CONTROLLER GAIN
M:	T03522	sec	BOILER CONTR INTEGRATION TIME
N:	C03525	%/%	BOILER CONTR STEAM FEEDF GAIN
O:			
P:	T03524	degC	BOILER SH STEAM TEMP SET POINT
Q:			
R:	C03537	<0-1>	BOILER COMBUSTION COEFF. (O2 INFLUENCE)
S:			
T:			

2.58 Page:0082 M** STEAM BOILER - ENERGY MONITOR

A:			
B:			
C:	X03647	<0-1>	BOILER MONITOR RESET COMMAND
D:			
E:			
F:			
G:	M03651	tonn	TOTAL BOILER OIL MASS
H:	M03650	tonn	TOTAL BOILER STEAM MASS
I:	Z03653	US$	TOTAL BOILER OIL COST
J:			
K:			
L:	Z03655	$/ton	BOILER FUEL OIL PRICE (input)
M:	Z03656	$/ton	CURRENT STEAM COST (result)
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.59 Page:0083 M** INERT GAS GENERATOR (1)

A:	V03572	<0-1>			IG SCRUBBER PUMP SEA CHEST VALVE
B:	V03573	<0-1>			IG SCRUBBER PUMP DISCHARGE VALVE
C:	V03577	<0-1>			IG SUPPLY LINE SHUT OFF VALVE
D:	G03574	m3/h			IG SUPPLY LINE GAS FLOW
E:	T03575	degC			IG SUPPLY LINE GAS TEMP
F:	X03576	%			IG SUPPLY LINE OXY CONTENT
G:	R03570	<0-1>			IG SCRUBBER PUMP
H:	V03571	<0-1>			IG SCRUBBER SW DRAIN VALVE
I:	L03572	m	L=0.2	H=1.5	IG SCRUBBER SW LEVEL
J:	T03573	degC	L=20.0	H=100.0	IG SCRUBBER GAS OUTLET TEMP
K:					
L:	R03540	<0-1>			IG FAN 1 START
M:	V03541	<0-1>			IG FAN 1 DISCHARGE VALVE
N:	V03542	<0-1>			IG FAN 1 AIR SUCTION VALVE
O:	V03543	<0-1>			IG FAN 1 GAS SUCTION VALVE
P:					
Q:	R03544	<0-1>			IG FAN 2 START
R:	V03545	<0-1>			IG FAN 2 DISCHARGE VALVE
S:	V03546	<0-1>			IG FAN 2 AIR SUCTION VALVE
T:	V03547	<0-1>			IG FAN 2 GAS SUCTION VALVE

2.60 Page:0084 M** INERT GAS GENERATOR (2)

A:	V03530	<0-1>			DECK SEAL PUMP SEA CHEST VALVE
B:	V03531	<0-1>			DECK SEAL PUMP DISCHARGE VALVE
C:	V03533	%			IG CONTROL VALVE
D:	V03538	<0-1>			IG MAIN CONTROL VALVE
E:	V03532	<0-1>			IG VENT VALVE
F:	V03554	<0-1>			IG DECK LINE SUPPLY VALVE
G:	P03555	bar	L=0.0	H=0.1	IG DECK LINE GAS PRESSURE
H:	X03556	%	L=0.0	H=7.0	IG DECK LINE OXY CONTENT
I:	X03557	%			IG DECK LINE HC CONTENT
J:	L03534	m	L=0.5	H=0.8	IG DECK SEAL SW LEVEL
K:	R03536	<0-1>			IG DECK SEAL SW PUMP NO 1
L:	V03535	<0-1>			IG DECK SEAL SW DRAIN VALVE
M:	P03550	bar	L=0.0	H=0.1	IG DISCHARGE LINE PRESSURE
N:	G03551	m3/h			IG DISCHARGE LINE FLOW
O:	X03552	%	L=0.0	H=6.0	IG DISCHARGE LINE OXY CONTENT
P:	X03553	%			IG DISCHARGE LINE HC CONTENT
Q:					
R:	V03563	<0-1>			IG ISOLATION
S:	X03564	%			IG OXYGEN AT ISOLATION
T:	P03565	bar			IG PRESSURE AT ISOLATION

2.61 Page:0090 M** BALLAST TANK - FP MAIN VARIABLES

A:						
B:						
C:	U00012	m	L=0.5	H=25.0	FPT	TANK ULLAGE (measured)
D:						
E:	L00011	m			FPT	SOUNDING (even keel)
F:	U00010	m			FPT	TANK ULLAGE (even keel)
G:	V00002	%			FPT	TANK VOLUME (cap. 12113 m3)
H:						
I:	M00025	tonn			FPT	CLEAN WATER MASS
J:						
K:						
L:						
M:						
N:	V00035	%			FPT	BOTTOM VALVE
O:	G00040	m3/h			FPT	BOTTOM OUTLET FLOW
P:	G00017	m3/s	L=0.0	H=1.0	FPT	TANK TOP OVERFLOW
Q:						
R:						
S:						
T:						

2.62 Page:0091 M** BALLAST TANK - FP MISCELLANEOUS

A:						
B:						
C:	T00053	degC	L=40.0	H=100.0	FPT	TEMPERATURE
D:						
E:	E00054	kW			FPT	HEAT LOSS TO SEA/AIR
F:	E00055	kW			FPT	HEAT LOSS TO ADJACENT TANKS
G:						
H:						
I:	P00045	bar			FPT	LEVEL+GAS PRESSURE
J:	P00046	bar			FPT	GEODETIC PRESSURE
K:	P00047	bar			FPT	TOTAL TANK BOTTOM PRESSURE
L:						
M:	D00021	kg/m3			FPT	WTR DENSITY (at 15 dgrC)
N:						
O:						
P:						
Q:						
R:						
S:						
T:						

2.63 Page:0100 M** CARGO TANK CT-1 MAIN VARIABLES

A:						
B:	U00112	m	L=0.5	H=25.0	CT1	TANK ULLAGE (measured)
C:						
D:	L00111	m			CT1	SOUNDING (even keel)
E:	U00110	m			CT1	TANK ULLAGE (even keel)
F:	V00102	%			CT1	TANK VOLUME (cap. 30813 m3)
G:	V00101	m3			CT1	TOTAL TANK LIQUID VOLUME
H:	M00103	tonn			CT1	TOTAL TANK MASS (incl residues)
I:	M00105	tonn			CT1	TOTAL RESIDUES IN TANK
J:						
K:	G00150	m3/h			CT1	TOTAL BOTTOM OUTLET FLOW
L:						
M:	G00167	m3/h			CT1	TANK CLEANING (SWW or COW) FLOW
N:						
O:	P00126	bar	L=-0.1	H=0.1	CT1	TANK ATMOSPHERIC PRESSURE
P:	X00127	%	L=0.0	H=8.0	CT1	OXYGEN CONTENT
Q:	X00130	%			CT1	HYDRO CARBON CONTENT
R:						
S:	T00153	degC	L=40.0	H=100.0	CT1	CARGO TEMPERATURE
T:						

2.64 Page:0101 M** CARGO TANK CT-1 VALVES

A:				
B:				
C:	V00136	<0-1>	CT1	BOTTOM VALVE - CNTR
D:	V00137	%	CT1	BOTTOM VALVE - STBD
E:	V00135	%	CT1	BOTTOM VALVE - PORT
F:				
G:				
H:	V00164	<0-1>	CT1	COW SUPPLY VALVE
I:				
J:				
K:	V00161	<0-1>	CT1	INERT GAS SUPPLY VALVE
L:	V00162	<0-1>	CT1	INERT GAS OUTLET VALVE (P/V bypass)
M:	V00163	<0-1>	CT1	INERT GAS P/V VALVE
N:				
O:				
P:				
Q:				
R:				
S:				
T:				

2.65 Page:0102 M** CARGO TANK CT-1 FLOWS

A:						
B:	G00141	m3/h			CT1	BOTTOM OUTLET FLOW - CNTR SUCTION
C:	G00142	m3/h			CT1	BOTTOM OUTLET FLOW - STBD SUCTION
D:	G00140	m3/h			CT1	BOTTOM OUTLET FLOW - PORT SUCTION
E:						
F:						
G:	G00117	m3/s	L=0.0	H=1.0	CT1	TANK TOP OVERFLOW
H:						
I:	G00143	m3/h			CT1	COW CLEANING FLOW
J:	G00144	m3/h			CT1	SWW CLEANING FLOW
K:						
L:	G00133	m3/h			CT1	INERT GAS FLOW FROM MAIN LINE
M:	G00134	m3/h			CT1	INERT GAS FLOW TO DECK
N:						
O:	G00170	%			CT1	TOTAL SUCTION BOBBLE FLOW
P:						
Q:						
R:						
S:						
T:						

2.66 Page:0103 M** CARGO TANK CT-1 LEVELS/MASSES

A:	U00110	m	CT1	TANK ULLAGE (even keel)
B:	L00111	m	CT1	SOUNDING (even keel)
C:				
D:	L00113	m	CT1	CLEAN OIL INTERFACE LEVEL
E:	L00114	m	CT1	CLEAN WTR INTERFACE LEVEL
F:	X00116	%	CT1	OIL CONTENT IN WTR/OIL MIXTURE
G:				
H:	M00103	tonn	CT1	TOTAL TANK MASS (incl residues)
I:	V00102	%	CT1	TANK VOLUME (cap. 30813 m3)
J:				
K:	M00122	tonn	CT1	CLEAN OIL MASS
L:	M00123	tonn	CT1	DIRTY OIL MASS
M:	M00124	tonn	CT1	DIRTY WATER MASS
N:	M00125	tonn	CT1	CLEAN WATER MASS
O:	M00107	tonn	CT1	HARD RESIDUES
P:	M00106	tonn	CT1	SOFT RESIDUES
Q:	M00115	tonn	CT1	DRIP RESIDUES
R:				
S:	D00120	kg/m3	CT1	OIL DENSITY (at 15 dgrC)
T:	D00121	kg/m3	CT1	WTR DENSITY (at 15 dgrC)

2.67 Page:0104 M** CARGO TANK CT-1 HEATING

A:						
B:						
C:						
D:	T00153	degC	L=40.0	H=100.0	CT1	CARGO TEMPERATURE
E:						
F:	V00156	%			CT1	CARGO HEATING STEAM VALVE
G:	G00157	m3/h			CT1	CARGO HEATING STEAM FLOW
H:						
I:	E00160	kW			CT1	HEAT FROM STEAM
J:	E00154	kW			CT1	HEAT LOSS TO SEA/AIR
K:	E00155	kW			CT1	HEAT LOSS TO ADJACENT TANKS
L:						
M:						
N:						
O:						
P:						
Q:						
R:						
S:						
T:						

2.68 Page:0105 M** CARGO TANK CT-1 MISCELLANEOUS

A:						
B:	Z00172	<0-2>			CT1	IG INITIATION (1=air , 2=IG)
C:						
D:						
E:	P00126	bar	L=-0.1	H=0.1	CT1	TANK ATMOSPHERIC PRESSURE
F:	X00127	%	L=0.0	H=8.0	CT1	OXYGEN CONTENT
G:	X00130	%			CT1	HYDRO CARBON CONTENT
H:						
I:	M00131	kg			CT1	INERT GAS MASS (O2+CO2+N2)
J:	M00132	kg			CT1	HYDRO CARBON MASS
K:						
L:	P00145	bar			CT1	LIQUID+GAS PRESSURE
M:	P00146	bar			CT1	GEODETIC PRESSURE
N:	P00147	bar			CT1	TOTAL TANK BOTTOM PRESSURE
O:						
P:	Z00168	DEG			CT1	TANK CLEANING UPPER LIMIT
Q:	Z00169	DEG			CT1	TANK CLEANING LOWER LIMIT
R:						
S:						
T:						

2.69 Page:0110 M** CARGO TANK WT-1-S MAIN VARIABLES

A:					
B:	U00212	m	L=0.5	H=25.0	WT1S TANK ULLAGE (measured)
C:					
D:	L00211	m			WT1S SOUNDING (even keel)
E:	U00210	m			WT1S TANK ULLAGE (even keel)
F:	V00202	%			WT1S TANK VOLUME (cap. 12554 m3)
G:	V00201	m3			WT1S TOTAL TANK LIQUID VOLUME
H:	M00203	tonn			WT1S TOTAL TANK MASS (incl residues)
I:	M00205	tonn			WT1S TOTAL RESIDUES IN TANK
J:					
K:	G00250	m3/h			WT1S TOTAL BOTTOM OUTLET FLOW
L:					
M:	G00267	m3/h			WT1S TANK CLEANING (SWW or COW) FLOW
N:					
O:	P00226	bar	L=-0.1	H=0.1	WT1S TANK ATMOSPHERIC PRESSURE
P:	X00227	%	L=0.0	H=8.0	WT1S OXYGEN CONTENT
Q:	X00230	%			WT1S HYDRO CARBON CONTENT
R:					
S:	T00253	degC	L=40.0	H=100.0	WT1S CARGO TEMPERATURE
T:					

2.70 Page:0111 M** CARGO TANK WT-1-S VALVES

A:			
B:			
C:	V00236	<0-1>	WT1S BOTTOM VALVE - CNTR
D:	V00235	%	WT1S BOTTOM VALVE - PORT
E:			
F:			
G:			
H:	V00264	<0-1>	WT1S COW SUPPLY VALVE
I:			
J:			
K:	V00261	<0-1>	WT1S INERT GAS SUPPLY VALVE
L:	V00262	<0-1>	WT1S INERT GAS OUTLET VALVE (P/V bypass)
M:	V00263	<0-1>	WT1S INERT GAS P/V VALVE
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.71 Page:0112 M** CARGO TANK WT-1-S FLOWS

A:					
B:	G00241	m3/h			WT1S BOTTOM OUTLET FLOW - CNTR SUCTION
C:	G00240	m3/h			WT1S BOTTOM OUTLET FLOW - PORT SUCTION
D:					
E:					
F:					
G:	G00217	m3/s	L=0.0	H=1.0	WT1S TANK TOP OVERFLOW
H:					
I:	G00243	m3/h			WT1S COW CLEANING FLOW
J:	G00244	m3/h			WT1S SWW CLEANING FLOW
K:					
L:	G00233	m3/h			WT1S INERT GAS FLOW FROM MAIN LINE
M:	G00234	m3/h			WT1S INERT GAS FLOW TO DECK
N:					
O:	G00270	%			WT1S TOTAL SUCTION BOBBLE FLOW
P:					
Q:					
R:					
S:					
T:					

2.72 Page:0113 M** CARGO TANK WT-1-S LEVELS/MASSES

A:	U00210	m	WT1S TANK ULLAGE (even keel)
B:	L00211	m	WT1S SOUNDING (even keel)
C:			
D:	L00213	m	WT1S CLEAN OIL INTERFACE LEVEL
E:	L00214	m	WT1S CLEAN WTR INTERFACE LEVEL
F:	X00216	%	WT1S OIL CONTENT IN WTR/OIL MIXTURE
G:			
H:	M00203	tonn	WT1S TOTAL TANK MASS (incl residues)
I:	V00202	%	WT1S TANK VOLUME (cap. 12554 m3)
J:			
K:	M00222	tonn	WT1S CLEAN OIL MASS
L:	M00223	tonn	WT1S DIRTY OIL MASS
M:	M00224	tonn	WT1S DIRTY WATER MASS
N:	M00225	tonn	WT1S CLEAN WATER MASS
O:	M00207	tonn	WT1S HARD RESIDUES
P:	M00206	tonn	WT1S SOFT RESIDUES
Q:	M00215	tonn	WT1S DRIP RESIDUES
R:			
S:	D00220	kg/m3	WT1S OIL DENSITY (at 15 dgrC)
T:	D00221	kg/m3	WT1S WTR DENSITY (at 15 dgrC)

2.73 Page:0114 M** CARGO TANK WT-1-S HEATING

A:						
B:						
C:						
D:	T00253	degC	L=40.0	H=100.0	WT1S	CARGO TEMPERATURE
E:						
F:	V00256	%			WT1S	CARGO HEATING STEAM VALVE
G:	G00257	m3/h			WT1S	CARGO HEATING STEAM FLOW
H:						
I:	E00260	kW			WT1S	HEAT FROM STEAM
J:	E00254	kW			WT1S	HEAT LOSS TO SEA/AIR
K:	E00255	kW			WT1S	HEAT LOSS TO ADJACENT TANKS
L:						
M:						
N:						
O:						
P:						
Q:						
R:						
S:						
T:						

2.74 Page:0115 M** CARGO TANK WT-1-S MISCELLANEOUS

A:						
B:	Z00272	<0-2>			WT1S	IG INITIATION (1=air , 2=IG)
C:						
D:						
E:	P00226	bar	L=-0.1	H=0.1	WT1S	TANK ATMOSPHERIC PRESSURE
F:	X00227	%	L=0.0	H=8.0	WT1S	OXYGEN CONTENT
G:	X00230	%			WT1S	HYDRO CARBON CONTENT
H:						
I:	M00231	kg			WT1S	INERT GAS MASS (O2+CO2+N2)
J:	M00232	kg			WT1S	HYDRO CARBON MASS
K:						
L:	P00245	bar			WT1S	LIQUID+GAS PRESSURE
M:	P00246	bar			WT1S	GEODETIC PRESSURE
N:	P00247	bar			WT1S	TOTAL TANK BOTTOM PRESSURE
O:						
P:	Z00268	DEG			WT1S	TANK CLEANING UPPER LIMIT
Q:	Z00269	DEG			WT1S	TANK CLEANING LOWER LIMIT
R:						
S:						
T:						

2.75 Page:0120 M** CARGO TANK WT-1-P MAIN VARIABLES

A:	U00312	m	L=0.5	H=25.0	WT1P TANK ULLAGE (measured)
B:					
C:	L00311	m			WT1P SOUNDING (even keel)
D:	U00310	m			WT1P TANK ULLAGE (even keel)
E:	V00302	%			WT1P TANK VOLUME (cap. 12554 m3)
F:					
G:	M00303	tonn			WT1P TOTAL TANK MASS (incl residues)
H:	M00305	tonn			WT1P TOTAL RESIDUES IN TANK
I:					
J:	G00350	m3/h			WT1P TOTAL BOTTOM OUTLET FLOW
K:					
L:	G00367	m3/h			WT1P TANK CLEANING (SWW or COW) FLOW
M:					
N:	P00326	bar	L=-0.1	H=0.1	WT1P TANK ATMOSPHERIC PRESSURE
O:	X00327	%	L=0.0	H=8.0	WT1P OXYGEN CONTENT
P:	X00330	%			WT1P HYDRO CARBON CONTENT
Q:					
R:	T00353	degC	L=40.0	H=100.0	WT1P CARGO TEMPERATURE
S:					
T:					

2.76 Page:0121 M** CARGO TANK WT-1-P VALVES

A:			
B:			
C:			
D:	V00336	<0-1>	WT1P BOTTOM VALVE - CNTR
E:	V00337	%	WT1P BOTTOM VALVE - STBD
F:			
G:			
H:	V00364	<0-1>	WT1P COW SUPPLY VALVE
I:			
J:			
K:	V00361	<0-1>	WT1P INERT GAS SUPPLY VALVE
L:	V00362	<0-1>	WT1P INERT GAS OUTLET VALVE (P/V bypass)
M:	V00363	<0-1>	WT1P INERT GAS P/V VALVE
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.77 Page:0122 M** CARGO TANK WT-1-P FLOWS

A:
B:
C: G00341 m3/h WT1P BOTTOM OUTLET FLOW - CNTR SUCTION
D: G00342 m3/h WT1P BOTTOM OUTLET FLOW - STBD SUCTION
E:
F:
G: G00317 m3/s L=0.0 H=1.0 WT1P TANK TOP OVERFLOW
H:
I: G00343 m3/h WT1P COW CLEANING FLOW
J: G00344 m3/h WT1P SWW CLEANING FLOW
K:
L: G00333 m3/h WT1P INERT GAS FLOW FROM MAIN LINE
M: G00334 m3/h WT1P INERT GAS FLOW TO DECK
N:
O: G00370 % WT1P TOTAL SUCTION BOBBLE FLOW
P:
Q:
R:
S:
T:

2.78 Page:0123 M** CARGO TANK WT-1-P LEVELS/MASSES

A: U00310 m WT1P TANK ULLAGE (even keel)
B: L00311 m WT1P SOUNDING (even keel)
C:
D: L00313 m WT1P CLEAN OIL INTERFACE LEVEL
E: L00314 m WT1P CLEAN WTR INTERFACE LEVEL
F: X00316 % WT1P OIL CONTENT IN WTR/OIL MIXTURE
G:
H: M00303 tonn WT1P TOTAL TANK MASS (incl residues)
I: V00302 % WT1P TANK VOLUME (cap. 12554 m3)
J:
K: M00322 tonn WT1P CLEAN OIL MASS
L: M00323 tonn WT1P DIRTY OIL MASS
M: M00324 tonn WT1P DIRTY WATER MASS
N: M00325 tonn WT1P CLEAN WATER MASS
O: M00307 tonn WT1P HARD RESIDUES
P: M00306 tonn WT1P SOFT RESIDUES
Q: M00315 tonn WT1P DRIP RESIDUES
R:
S: D00320 kg/m3 WT1P OIL DENSITY (at 15 dgrC)
T: D00321 kg/m3 WT1P WTR DENSITY (at 15 dgrC)

2.79 Page:0124 M** CARGO TANK WT-1-P HEATING

A:						
B:						
C:						
D:	T00353	degC	L=40.0	H=100.0	WT1P	CARGO TEMPERATURE
E:	V00356	%			WT1P	CARGO HEATING STEAM VALVE
F:	G00357	m3/h			WT1P	CARGO HEATING STEAM FLOW
G:						
H:	E00360	kW			WT1P	HEAT FROM STEAM
I:	E00354	kW			WT1P	HEAT LOSS TO SEA/AIR
J:	E00355	kW			WT1P	HEAT LOSS TO ADJACENT TANKS
K:						
L:						
M:						
N:						
O:						
P:						
Q:						
R:						
S:						
T:						

2.80 Page:0125 M** CARGO TANK WT-1-P MISCELLANEOUS

A:						
B:	Z00372	<0-2>			WT1P	IG INITIATION (1=air , 2=IG)
C:						
D:						
E:	P00326	bar	L=-0.1	H=0.1	WT1P	TANK ATMOSPHERIC PRESSURE
F:	X00327	%	L=0.0	H=8.0	WT1P	OXYGEN CONTENT
G:	X00330	%			WT1P	HYDRO CARBON CONTENT
H:						
I:	M00331	kg			WT1P	INERT GAS MASS (O2+CO2+N2)
J:	M00332	kg			WT1P	HYDRO CARBON MASS
K:						
L:	P00345	bar			WT1P	LIQUID+GAS PRESSURE
M:	P00346	bar			WT1P	GEODETIC PRESSURE
N:	P00347	bar			WT1P	TOTAL TANK BOTTOM PRESSURE
O:						
P:	Z00368	DEG			WT1P	TANK CLEANING UPPER LIMIT
Q:	Z00369	DEG			WT1P	TANK CLEANING LOWER LIMIT
R:						
S:						
T:						

2.81 Page:0200 M** CARGO TANK CT-2 MAIN VARIABLES

A:						
B:	U00412	m	L=0.5	H=25.0	CT2	TANK ULLAGE (measured)
C:						
D:	L00411	m			CT2	SOUNDING (even keel)
E:	U00410	m			CT2	TANK ULLAGE (even keel)
F:	V00402	%			CT2	TANK VOLUME (cap. 30818 m3)
G:	V00401	m3			CT2	TOTAL TANK LIQUID VOLUME
H:	M00403	tonn			CT2	TOTAL TANK MASS (incl residues)
I:	M00405	tonn			CT2	TOTAL RESIDUES IN TANK
J:						
K:	G00450	m3/h			CT2	TOTAL BOTTOM OUTLET FLOW
L:						
M:	G00467	m3/h			CT2	TANK CLEANING (SWW or COW) FLOW
N:						
O:	P00426	bar	L=-0.1	H=0.1	CT2	TANK ATMOSPHERIC PRESSURE
P:	X00427	%	L=0.0	H=8.0	CT2	OXYGEN CONTENT
Q:	X00430	%			CT2	HYDRO CARBON CONTENT
R:						
S:	T00453	degC	L=40.0	H=100.0	CT2	CARGO TEMPERATURE
T:						

2.82 Page:0201 M** CARGO TANK CT-2 VALVES

A:				
B:				
C:	V00436	<0-1>	CT2	BOTTOM VALVE - CNTR
D:	V00437	%	CT2	BOTTOM VALVE - STBD
E:	V00435	%	CT2	BOTTOM VALVE - PORT
F:				
G:				
H:	V00464	<0-1>	CT2	COW SUPPLY VALVE
I:				
J:				
K:	V00461	<0-1>	CT2	INERT GAS SUPPLY VALVE
L:	V00462	<0-1>	CT2	INERT GAS OUTLET VALVE (P/V bypass)
M:	V00463	<0-1>	CT2	INERT GAS P/V VALVE
N:				
O:				
P:				
Q:				
R:				
S:				
T:				

2.83 Page:0202 M** CARGO TANK CT-2 FLOWS

A:					
B:	G00441	m3/h			CT2 BOTTOM OUTLET FLOW - CNTR SUCTION
C:	G00442	m3/h			CT2 BOTTOM OUTLET FLOW - STBD SUCTION
D:	G00440	m3/h			CT2 BOTTOM OUTLET FLOW - PORT SUCTION
E:	G03260	m3/h			BW DROP FLOW INTO TANK (CT2)
F:					
G:	G00417	m3/s	L=0.0	H=1.0	CT2 TANK TOP OVERFLOW
H:					
I:	G00443	m3/h			CT2 COW CLEANING FLOW
J:	G00444	m3/h			CT2 SWW CLEANING FLOW
K:					
L:	G00433	m3/h			CT2 INERT GAS FLOW FROM MAIN LINE
M:	G00434	m3/h			CT2 INERT GAS FLOW TO DECK
N:					
O:	G00470	%			CT2 TOTAL SUCTION BOBBLE FLOW
P:					
Q:					
R:					
S:					
T:					

2.84 Page:0203 M** CARGO TANK CT-2 LEVELS/MASSES

A:	U00410	m	CT2 TANK ULLAGE (even keel)
B:	L00411	m	CT2 SOUNDING (even keel)
C:			
D:	L00413	m	CT2 CLEAN OIL INTERFACE LEVEL
E:	L00414	m	CT2 CLEAN WTR INTERFACE LEVEL
F:	X00416	%	CT2 OIL CONTENT IN WTR/OIL MIXTURE
G:			
H:	M00403	tonn	CT2 TOTAL TANK MASS (incl residues)
I:	V00402	%	CT2 TANK VOLUME (cap. 30818 m3)
J:			
K:	M00422	tonn	CT2 CLEAN OIL MASS
L:	M00423	tonn	CT2 DIRTY OIL MASS
M:	M00424	tonn	CT2 DIRTY WATER MASS
N:	M00425	tonn	CT2 CLEAN WATER MASS
O:	M00407	tonn	CT2 HARD RESIDUES
P:	M00406	tonn	CT2 SOFT RESIDUES
Q:	M00415	tonn	CT2 DRIP RESIDUES
R:			
S:	D00420	kg/m3	CT2 OIL DENSITY (at 15 dgrC)
T:	D00421	kg/m3	CT2 WTR DENSITY (at 15 dgrC)

2.85 Page:0204 M** CARGO TANK CT-2 HEATING

A:						
B:						
C:						
D:	T00453	degC	L=40.0	H=100.0	CT2	CARGO TEMPERATURE
E:						
F:	V00456	%			CT2	CARGO HEATING STEAM VALVE
G:	G00457	m3/h			CT2	CARGO HEATING STEAM FLOW
H:						
I:	E00460	kW			CT2	HEAT FROM STEAM
J:	E00454	kW			CT2	HEAT LOSS TO SEA/AIR
K:	E00455	kW			CT2	HEAT LOSS TO ADJACENT TANKS
L:						
M:						
N:						
O:						
P:						
Q:						
R:						
S:						
T:						

2.86 Page:0205 M** CARGO TANK CT-2 MISCELLANEOUS

A:						
B:	Z00472	<0-2>			CT2	IG INITIATION (1=air , 2=IG)
C:						
D:						
E:	P00426	bar	L=-0.1	H=0.1	CT2	TANK ATMOSPHERIC PRESSURE
F:	X00427	%	L=0.0	H=8.0	CT2	OXYGEN CONTENT
G:	X00430	%			CT2	HYDRO CARBON CONTENT
H:						
I:	M00431	kg			CT2	INERT GAS MASS (O2+CO2+N2)
J:	M00432	kg			CT2	HYDRO CARBON MASS
K:						
L:	P00445	bar			CT2	LIQUID+GAS PRESSURE
M:	P00446	bar			CT2	GEODETIC PRESSURE
N:	P00447	bar			CT2	TOTAL TANK BOTTOM PRESSURE
O:						
P:	Z00468	DEG			CT2	TANK CLEANING UPPER LIMIT
Q:	Z00469	DEG			CT2	TANK CLEANING LOWER LIMIT
R:						
S:						
T:						

2.87 Page:0210 M** CARGO TANK WT-2-S MAIN VARIABLES

A:					
B:	U00512	m	L=0.5	H=25.0	WT2S TANK ULLAGE (measured)
C:					
D:	L00511	m			WT2S SOUNDING (even keel)
E:	U00510	m			WT2S TANK ULLAGE (even keel)
F:	V00502	%			WT2S TANK VOLUME (cap. 9283 m3)
G:	V00501	m3			WT2S TOTAL TANK LIQUID VOLUME
H:	M00503	tonn			WT2S TOTAL TANK MASS (incl residues)
I:	M00505	tonn			WT2S TOTAL RESIDUES IN TANK
J:					
K:	G00550	m3/h			WT2S TOTAL BOTTOM OUTLET FLOW
L:					
M:	G00567	m3/h			WT2S TANK CLEANING (SWW or COW) FLOW
N:					
O:	P00526	bar	L=-0.1	H=0.1	WT2S TANK ATMOSPHERIC PRESSURE
P:	X00527	%	L=0.0	H=8.0	WT2S OXYGEN CONTENT
Q:	X00530	%			WT2S HYDRO CARBON CONTENT
R:					
S:	T00553	degC	L=40.0	H=100.0	WT2S CARGO TEMPERATURE
T:					

2.88 Page:0211 M** CARGO TANK WT-2-S VALVES

A:			
B:			
C:	V00536	<0-1>	WT2S BOTTOM VALVE - CNTR
D:	V00535	%	WT2S BOTTOM VALVE - PORT
E:			
F:			
G:			
H:	V00564	<0-1>	WT2S COW SUPPLY VALVE
I:	V00568	<0-1>	WT2S COW SUPPLY VALVE
J:			
K:	V00561	<0-1>	WT2S INERT GAS SUPPLY VALVE
L:	V00562	<0-1>	WT2S INERT GAS OUTLET VALVE (P/V bypass)
M:	V00563	<0-1>	WT2S INERT GAS P/V VALVE
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.89 Page:0212 M** CARGO TANK WT-2-S FLOWS

A:					
B:	G00541	m3/h			WT2S BOTTOM OUTLET FLOW - CNTR SUCTION
C:	G00540	m3/h			WT2S BOTTOM OUTLET FLOW - PORT SUCTION
D:	G03261	m3/h			BW DROP FLOW INTO TANK (WT2S)
E:					
F:	G00517	m3/s	L=0.0	H=1.0	WT2S TANK TOP OVERFLOW
G:					
H:	G00543	m3/h			WT2S COW CLEANING FLOW
I:	G00544	m3/h			WT2S SWW CLEANING FLOW
J:					
K:	G00533	m3/h			WT2S INERT GAS FLOW FROM MAIN LINE
L:	G00534	m3/h			WT2S INERT GAS FLOW TO DECK
M:					
N:	G00570	%			WT2S TOTAL SUCTION BOBBLE FLOW
O:					
P:					
Q:					
R:					
S:					
T:					

2.90 Page:0213 M** CARGO TANK WT-2-S LEVELS/MASSES

A:	U00510	m	WT2S TANK ULLAGE (even keel)
B:	L00511	m	WT2S SOUNDING (even keel)
C:			
D:	L00513	m	WT2S CLEAN OIL INTERFACE LEVEL
E:	L00514	m	WT2S CLEAN WTR INTERFACE LEVEL
F:	X00516	%	WT2S OIL CONTENT IN WTR/OIL MIXTURE
G:			
H:	M00503	tonn	WT2S TOTAL TANK MASS (incl residues)
I:	V00502	%	WT2S TANK VOLUME (cap. 9283 m3)
J:			
K:	M00522	tonn	WT2S CLEAN OIL MASS
L:	M00523	tonn	WT2S DIRTY OIL MASS
M:	M00524	tonn	WT2S DIRTY WATER MASS
N:	M00525	tonn	WT2S CLEAN WATER MASS
O:	M00507	tonn	WT2S HARD RESIDUES
P:	M00506	tonn	WT2S SOFT RESIDUES
Q:	M00515	tonn	WT2S DRIP RESIDUES
R:			
S:	D00520	kg/m3	WT2S OIL DENSITY (at 15 dgrC)
T:	D00521	kg/m3	WT2S WTR DENSITY (at 15 dgrC)

2.91 Page:0214 M** CARGO TANK WT-2-S HEATING

A:					
B:					
C:					
D:	T00553	degC	L=40.0	H=100.0	WT2S CARGO TEMPERATURE
E:					
F:	V00556	%			WT2S CARGO HEATING STEAM VALVE
G:	G00557	m3/h			WT2S CARGO HEATING STEAM FLOW
H:					
I:	E00560	kW			WT2S HEAT FROM STEAM
J:	E00554	kW			WT2S HEAT LOSS TO SEA/AIR
K:	E00555	kW			WT2S HEAT LOSS TO ADJACENT TANKS
L:					
M:					
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.92 Page:0215 M** CARGO TANK WT-2-S MISCELLANEOUS

A:					
B:	Z00572	<0-2>			WT2S IG INITIATION (1=air , 2=IG)
C:					
D:					
E:	P00526	bar	L=-0.1	H=0.1	WT2S TANK ATMOSPHERIC PRESSURE
F:	X00527	%	L=0.0	H=8.0	WT2S OXYGEN CONTENT
G:	X00530	%			WT2S HYDRO CARBON CONTENT
H:					
I:	M00531	kg			WT2S INERT GAS MASS (O2+CO2+N2)
J:	M00532	kg			WT2S HYDRO CARBON MASS
K:					
L:	P00545	bar			WT2S LIQUID+GAS PRESSURE
M:	P00546	bar			WT2S GEODETIC PRESSURE
N:	P00547	bar			WT2S TOTAL TANK BOTTOM PRESSURE
O:					
P:	Z00568	DEG			WT2S TANK CLEANING UPPER LIMIT
Q:	Z00569	DEG			WT2S TANK CLEANING LOWER LIMIT
R:					
S:					
T:					

2.93 Page:0220 M** CARGO TANK WT-2-P MAIN VARIABLES

A:					
B: U00612	m	L=0.5	H=25.0	WT2P	TANK ULLAGE (measured)
C:					
D: L00611	m			WT2P	SOUNDING (even keel)
E: U00610	m			WT2P	TANK ULLAGE (even keel)
F: V00602	%			WT2P	TANK VOLUME (cap. 9283 m3)
G: V00601	m3			WT2P	TOTAL TANK LIQUID VOLUME
H: M00603	tonn			WT2P	TOTAL TANK MASS (incl residues)
I: M00605	tonn			WT2P	TOTAL RESIDUES IN TANK
J:					
K: G00650	m3/h			WT2P	TOTAL BOTTOM OUTLET FLOW
L:					
M: G00667	m3/h			WT2P	TANK CLEANING (SWW or COW) FLOW
N:					
O: P00626	bar	L=-0.1	H=0.1	WT2P	TANK ATMOSPHERIC PRESSURE
P: X00627	%	L=0.0	H=8.0	WT2P	OXYGEN CONTENT
Q: X00630	%			WT2P	HYDRO CARBON CONTENT
R:					
S: T00653	degC	L=40.0	H=100.0	WT2P	CARGO TEMPERATURE
T:					

2.94 Page:0221 M** CARGO TANK WT-2-P VALVES

A:			
B:			
C:			
D: V00636	<0-1>	WT2P	BOTTOM VALVE - CNTR
E: V00637	%	WT2P	BOTTOM VALVE - STBD
F:			
G:			
H: V00664	<0-1>	WT2P	COW SUPPLY VALVE
I: V00668	<0-1>	WT2P	COW SUPPLY VALVE
J:			
K: V00661	<0-1>	WT2P	INERT GAS SUPPLY VALVE
L: V00662	<0-1>	WT2P	INERT GAS OUTLET VALVE (P/V bypass)
M: V00663	<0-1>	WT2P	INERT GAS P/V VALVE
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.95 Page:0222 M** CARGO TANK WT-2-P FLOWS

A:				
B:				
C: G00641	m3/h			WT2P BOTTOM OUTLET FLOW - CNTR SUCTION
D: G00642	m3/h			WT2P BOTTOM OUTLET FLOW - STBD SUCTION
E: G03262	m3/h			BW DROP FLOW INTO TANK (WT2P)
F:				
G: G00617	m3/s	L=0.0	H=1.0	WT2P TANK TOP OVERFLOW
H:				
I: G00643	m3/h			WT2P COW CLEANING FLOW
J: G00644	m3/h			WT2P SWW CLEANING FLOW
K:				
L: G00633	m3/h			WT2P INERT GAS FLOW FROM MAIN LINE
M: G00634	m3/h			WT2P INERT GAS FLOW TO DECK
N:				
O: G00670	%			WT2P TOTAL SUCTION BOBBLE FLOW
P:				
Q:				
R:				
S:				
T:				

2.96 Page:0223 M** CARGO TANK WT-2-P LEVELS/MASSES

A: U00610	m	WT2P TANK ULLAGE (even keel)
B: L00611	m	WT2P SOUNDING (even keel)
C:		
D: L00613	m	WT2P CLEAN OIL INTERFACE LEVEL
E: L00614	m	WT2P CLEAN WTR INTERFACE LEVEL
F: X00616	%	WT2P OIL CONTENT IN WTR/OIL MIXTURE
G:		
H: M00603	tonn	WT2P TOTAL TANK MASS (incl residues)
I: V00602	%	WT2P TANK VOLUME (cap. 9283 m3)
J:		
K: M00622	tonn	WT2P CLEAN OIL MASS
L: M00623	tonn	WT2P DIRTY OIL MASS
M: M00624	tonn	WT2P DIRTY WATER MASS
N: M00625	tonn	WT2P CLEAN WATER MASS
O: M00607	tonn	WT2P HARD RESIDUES
P: M00606	tonn	WT2P SOFT RESIDUES
Q: M00615	tonn	WT2P DRIP RESIDUES
R:		
S: D00620	kg/m3	WT2P OIL DENSITY (at 15 dgrC)
T: D00621	kg/m3	WT2P WTR DENSITY (at 15 dgrC)

2.97 Page:0224 M** CARGO TANK WT-2-P HEATING

A:						
B:						
C:						
D:	T00653	degC	L=40.0	H=100.0	WT2P	CARGO TEMPERATURE
E:						
F:	V00656	%			WT2P	CARGO HEATING STEAM VALVE
G:	G00657	m3/h			WT2P	CARGO HEATING STEAM FLOW
H:						
I:	E00660	kW			WT2P	HEAT FROM STEAM
J:	E00654	kW			WT2P	HEAT LOSS TO SEA/AIR
K:	E00655	kW			WT2P	HEAT LOSS TO ADJACENT TANKS
L:						
M:						
N:						
O:						
P:						
Q:						
R:						
S:						
T:						

2.98 Page:0225 M** CARGO TANK WT-2-P MISCELLANEOUS

A:						
B:	Z00672	<0-2>			WT2P	IG INITIATION (1=air , 2=IG)
C:						
D:						
E:	P00626	bar	L=-0.1	H=0.1	WT2P	TANK ATMOSPHERIC PRESSURE
F:	X00627	%	L=0.0	H=8.0	WT2P	OXYGEN CONTENT
G:	X00630	%			WT2P	HYDRO CARBON CONTENT
H:						
I:	M00631	kg			WT2P	INERT GAS MASS (O2+CO2+N2)
J:	M00632	kg			WT2P	HYDRO CARBON MASS
K:						
L:	P00645	bar			WT2P	LIQUID+GAS PRESSURE
M:	P00646	bar			WT2P	GEODETIC PRESSURE
N:	P00647	bar			WT2P	TOTAL TANK BOTTOM PRESSURE
O:						
P:	Z00668	DEG			WT2P	TANK CLEANING UPPER LIMIT
Q:	Z00669	DEG			WT2P	TANK CLEANING LOWER LIMIT
R:						
S:						
T:						

2.99 Page:0230 M** BALLAST TANK WT-3-S MAIN VARIABLES

A:					
B:					
C:	U00712	m	L=0.5	H=25.0	WT3BS TANK ULLAGE (measured)
D:					
E:	L00711	m			WT3BS SOUNDING (even keel)
F:	U00710	m			WT3BS TANK ULLAGE (even keel)
G:	V00702	%			WT3BS TANK VOLUME (cap. 5231 m3)
H:					
I:	M00725	tonn			WT3BS CLEAN WATER MASS
J:					
K:					
L:					
M:					
N:	V00735	%			WT3BS BOTTOM VALVE
O:	G00740	m3/h			WT3BS BOTTOM OUTLET FLOW
P:	G00717	m3/s	L=0.0	H=1.0	WT3BS TANK TOP OVERFLOW
Q:					
R:					
S:					
T:					

2.100 Page:0231 M** BALLAST TANK WT-3-S MISCELLANEOUS

A:					
B:	T00753	degC	L=40.0	H=100.0	WT3BS TEMPERATURE
C:					
D:	E00754	kW			WT3BS HEAT LOSS TO SEA/AIR
E:	E00755	kW			WT3BS HEAT LOSS TO ADJACENT TANKS
F:					
G:					
H:	P00745	bar			WT3BS LIQUID+GAS PRESSURE
I:	P00746	bar			WT3BS GEODETIC PRESSURE
J:	P00747	bar			WT3BS TOTAL TANK BOTTOM PRESSURE
K:					
L:	D00721	kg/m3			WT3BS WTR DENSITY (at 15 dgrC)
M:					
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.101 Page:0240 M** BALLAST TANK WT-3-P MAIN VARIABLES

A:					
B:					
C:	U01012	m	L=0.5	H=25.0	WT3P TANK ULLAGE (measured)
D:					
E:	L01011	m			WT3BP SOUNDING (even keel)
F:	U01010	m			WT3P TANK ULLAGE (even keel)
G:	V01002	%			WT3BP TANK VOLUME (cap. 5231 m3)
H:					
I:	M01025	tonn			WT3BP CLEAN WATER MASS
J:					
K:					
L:					
M:					
N:	V01035	%			WT3BP BOTTOM VALVE
O:	G01040	m3/h			WT3BP BOTTOM OUTLET FLOW
P:	G01017	m3/s	L=0.0	H=1.0	WT3BP TANK TOP OVERFLOW
Q:					
R:					
S:					
T:					

2.102 Page:0241 M** BALLAST TANK WT-3-P MISCELLANEOUS

A:					
B:	T01053	degC	L=40.0	H=100.0	WT3BP TEMPERATURE
C:					
D:	E01054	kW			WT3BP HEAT LOSS TO SEA/AIR
E:	E01055	kW			WT3BP HEAT LOSS TO ADJACENT TANKS
F:					
G:					
H:	P01045	bar			WT3BP LIQUID+GAS PRESSURE
I:	P01046	bar			WT3BP GEODETIC PRESSURE
J:	P01047	bar			WT3BP TOTAL TANK BOTTOM PRESSURE
K:					
L:	D01021	kg/m3			WT3BP WTR DENSITY (at 15 dgrC)
M:					
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.103 Page:0300 M** CARGO TANK CT-3 MAIN VARIABLES

A:						
B:	U01112	m	L=0.5	H=25.0	CT3	TANK ULLAGE (measured)
C:						
D:	L01111	m			CT3	SOUNDING (even keel)
E:	U01110	m			CT3	TANK ULLAGE (even keel)
F:	V01102	%			CT3	TANK VOLUME (cap. 30818 m3)
G:	V01101	m3			CT3	TOTAL TANK LIQUID VOLUME
H:	M01103	tonn			CT3	TOTAL TANK MASS (incl residues)
I:	M01105	tonn			CT3	TOTAL RESIDUES IN TANK
J:						
K:	G01150	m3/h			CT3	TOTAL BOTTOM OUTLET FLOW
L:						
M:	G01167	m3/h			CT3	TANK CLEANING (SWW or COW) FLOW
N:						
O:	P01126	bar	L=-0.1	H=0.1	CT3	TANK ATMOSPHERIC PRESSURE
P:	X01127	%	L=0.0	H=8.0	CT3	OXYGEN CONTENT
Q:	X01130	%			CT3	HYDRO CARBON CONTENT
R:						
S:	T01153	degC	L=40.0	H=100.0	CT3	CARGO TEMPERATURE
T:						

2.104 Page:0301 M** CARGO TANK CT-3 VALVES

A:				
B:				
C:	V01136	<0-1>	CT3	BOTTOM VALVE - CNTR
D:	V01137	%	CT3	BOTTOM VALVE - STBD
E:	V01135	%	CT3	BOTTOM VALVE - PORT
F:				
G:				
H:	V01164	<0-1>	CT3	COW SUPPLY VALVE
I:				
J:				
K:	V01161	<0-1>	CT3	INERT GAS SUPPLY VALVE
L:	V01162	<0-1>	CT3	INERT GAS OUTLET VALVE (P/V bypass)
M:	V01163	<0-1>	CT3	INERT GAS P/V VALVE
N:				
O:				
P:				
Q:				
R:				
S:				
T:				

2.105 Page:0302 M** CARGO TANK CT-3 FLOWS

A:					
B:	G01141	m3/h			CT3 BOTTOM OUTLET FLOW - CNTR SUCTION
C:	G01142	m3/h			CT3 BOTTOM OUTLET FLOW - STBD SUCTION
D:	G01140	m3/h			CT3 BOTTOM OUTLET FLOW - PORT SUCTION
E:					
F:					
G:	G01117	m3/s	L=0.0	H=1.0	CT3 TANK TOP OVERFLOW
H:					
I:	G01143	m3/h			CT3 COW CLEANING FLOW
J:	G01144	m3/h			CT3 SWW CLEANING FLOW
K:					
L:	G01133	m3/h			CT3 INERT GAS FLOW FROM MAIN LINE
M:	G01134	m3/h			CT3 INERT GAS FLOW TO DECK
N:					
O:	G01170	%			CT3 TOTAL SUCTION BOBBLE FLOW
P:					
Q:					
R:					
S:					
T:					

2.106 Page:0303 M** CARGO TANK CT-3 LEVELS/MASSES

A:	U01110	m	CT3 TANK ULLAGE (even keel)
B:	L01111	m	CT3 SOUNDING (even keel)
C:			
D:	L01113	m	CT3 CLEAN OIL INTERFACE LEVEL
E:	L01114	m	CT3 CLEAN WTR INTERFACE LEVEL
F:	X01116	%	CT3 OIL CONTENT IN WTR/OIL MIXTURE
G:			
H:	M01103	tonn	CT3 TOTAL TANK MASS (incl residues)
I:	V01102	%	CT3 TANK VOLUME (cap. 30818 m3)
J:			
K:	M01122	tonn	CT3 CLEAN OIL MASS
L:	M01123	tonn	CT3 DIRTY OIL MASS
M:	M01124	tonn	CT3 DIRTY WATER MASS
N:	M01125	tonn	CT3 CLEAN WATER MASS
O:	M01107	tonn	CT3 HARD RESIDUES
P:	M01106	tonn	CT3 SOFT RESIDUES
Q:	M01115	tonn	CT3 DRIP RESIDUES
R:			
S:	D01120	kg/m3	CT3 OIL DENSITY (at 15 dgrC)
T:	D01121	kg/m3	CT3 WTR DENSITY (at 15 dgrC)

2.107 Page:0304 M** CARGO TANK CT-3 HEATING

A:						
B:						
C:						
D:	T01153	degC	L=40.0	H=100.0	CT3	CARGO TEMPERATURE
E:						
F:	V01156	%			CT3	CARGO HEATING STEAM VALVE
G:	G01157	m3/h			CT3	CARGO HEATING STEAM FLOW
H:						
I:	E01160	kW			CT3	HEAT FROM STEAM
J:	E01154	kW			CT3	HEAT LOSS TO SEA/AIR
K:	E01155	kW			CT3	HEAT LOSS TO ADJACENT TANKS
L:						
M:						
N:						
O:						
P:						
Q:						
R:						
S:						
T:						

2.108 Page:0305 M** CARGO TANK CT-3 MISCELLANEOUS

A:						
B:	Z01172	<0-2>			CT3	IG INITIATION (1=air , 2=IG)
C:						
D:						
E:	P01126	bar	L=-0.1	H=0.1	CT3	TANK ATMOSPHERIC PRESSURE
F:	X01127	%	L=0.0	H=8.0	CT3	OXYGEN CONTENT
G:	X01130	%			CT3	HYDRO CARBON CONTENT
H:						
I:	M01131	kg			CT3	INERT GAS MASS (O2+CO2+N2)
J:	M01132	kg			CT3	HYDRO CARBON MASS
K:						
L:	P01145	bar			CT3	LIQUID+GAS PRESSURE
M:	P01146	bar			CT3	GEODETIC PRESSURE
N:	P01147	bar			CT3	TOTAL TANK BOTTOM PRESSURE
O:						
P:	Z01168	DEG			CT3	TANK CLEANING UPPER LIMIT
Q:	Z01169	DEG			CT3	TANK CLEANING LOWER LIMIT
R:						
S:						
T:						

2.109 Page:0310 M** CARGO TANK WT-4-S MAIN VARIABLES

A:						
B:	U01212	m	L=0.5	H=25.0	WT4S	TANK ULLAGE (measured)
C:						
D:	L01211	m			WT4S	SOUNDING (even keel)
E:	U01210	m			WT4S	TANK ULLAGE (even keel)
F:	V01202	%			WT4S	TANK VOLUME (cap. 14514 m3)
G:	V01201	m3			WT4S	TOTAL TANK LIQUID VOLUME
H:	M01203	tonn			WT4S	TOTAL TANK MASS (incl residues)
I:	M01205	tonn			WT4S	TOTAL RESIDUES IN TANK
J:						
K:	G01250	m3/h			WT4S	TOTAL BOTTOM OUTLET FLOW
L:						
M:	G01267	m3/h			WT4S	TANK CLEANING (SWW or COW) FLOW
N:						
O:	P01226	bar	L=-0.1	H=0.1	WT4S	TANK ATMOSPHERIC PRESSURE
P:	X01227	%	L=0.0	H=8.0	WT4S	OXYGEN CONTENT
Q:	X01230	%			WT4S	HYDRO CARBON CONTENT
R:						
S:	T01253	degC	L=40.0	H=100.0	WT4S	CARGO TEMPERATURE
T:						

2.110 Page:0311 M** CARGO TANK WT-4-S VALVES

A:				
B:				
C:	V01236	<0-1>	WT4S	BOTTOM VALVE - CNTR
D:	V01235	%	WT4S	BOTTOM VALVE - PORT
E:				
F:				
G:				
H:	V01264	<0-1>	WT4S	COW SUPPLY VALVE
I:				
J:				
K:	V01261	<0-1>	WT4S	INERT GAS SUPPLY VALVE
L:	V01262	<0-1>	WT4S	INERT GAS OUTLET VALVE (P/V bypass)
M:	V01263	<0-1>	WT4S	INERT GAS P/V VALVE
N:				
O:				
P:				
Q:				
R:				
S:				
T:				

2.111 Page:0312 M** CARGO TANK WT-4-S FLOWS

A:				
B: G01241	m3/h			WT4S BOTTOM OUTLET FLOW - CNTR SUCTION
C: G01240	m3/h			WT4S BOTTOM OUTLET FLOW - PORT SUCTION
D:				
E:				
F:				
G: G01217	m3/s	L=0.0	H=1.0	WT4S TANK TOP OVERFLOW
H:				
I: G01243	m3/h			WT4S COW CLEANING FLOW
J: G01244	m3/h			WT4S SWW CLEANING FLOW
K:				
L: G01233	m3/h			WT4S INERT GAS FLOW FROM MAIN LINE
M: G01234	m3/h			WT4S INERT GAS FLOW TO DECK
N:				
O: G01270	%			WT4S TOTAL SUCTION BOBBLE FLOW
P:				
Q:				
R:				
S:				
T:				

2.112 Page:0313 M** CARGO TANK WT-4-S LEVELS/MASSES

A: U01210	m	WT4S TANK ULLAGE (even keel)
B: L01211	m	WT4S SOUNDING (even keel)
C:		
D: L01213	m	WT4S CLEAN OIL INTERFACE LEVEL
E: L01214	m	WT4S CLEAN WTR INTERFACE LEVEL
F: X01216	%	WT4S OIL CONTENT IN WTR/OIL MIXTURE
G:		
H: M01203	tonn	WT4S TOTAL TANK MASS (incl residues)
I: V01202	%	WT4S TANK VOLUME (cap. 14514 m3)
J:		
K: M01222	tonn	WT4S CLEAN OIL MASS
L: M01223	tonn	WT4S DIRTY OIL MASS
M: M01224	tonn	WT4S DIRTY WATER MASS
N: M01225	tonn	WT4S CLEAN WATER MASS
O: M01207	tonn	WT4S HARD RESIDUES
P: M01206	tonn	WT4S SOFT RESIDUES
Q: M01215	tonn	WT4S DRIP RESIDUES
R:		
S: D01220	kg/m3	WT4S OIL DENSITY (at 15 dgrC)
T: D01221	kg/m3	WT4S WTR DENSITY (at 15 dgrC)

2.113 Page:0314 M** CARGO TANK WT-4-S HEATING

A:						
B:						
C:						
D:	T01253	degC	L=40.0	H=100.0	WT4S	CARGO TEMPERATURE
E:						
F:	V01256	%			WT4S	CARGO HEATING STEAM VALVE
G:	G01257	m3/h			WT4S	CARGO HEATING STEAM FLOW
H:						
I:	E01260	kW			WT4S	HEAT FROM STEAM
J:	E01254	kW			WT4S	HEAT LOSS TO SEA/AIR
K:	E01255	kW			WT4S	HEAT LOSS TO ADJACENT TANKS
L:						
M:						
N:						
O:						
P:						
Q:						
R:						
S:						
T:						

2.114 Page:0315 M** CARGO TANK WT-4-S MISCELLANEOUS

A:						
B:	Z01272	<0-2>			WT4S	IG INITIATION (1=air , 2=IG)
C:						
D:						
E:	P01226	bar	L=-0.1	H=0.1	WT4S	TANK ATMOSPHERIC PRESSURE
F:	X01227	%	L=0.0	H=8.0	WT4S	OXYGEN CONTENT
G:	X01230	%			WT4S	HYDRO CARBON CONTENT
H:						
I:	M01231	kg			WT4S	INERT GAS MASS (O2+CO2+N2)
J:	M01232	kg			WT4S	HYDRO CARBON MASS
K:						
L:	P01245	bar			WT4S	LIQUID+GAS PRESSURE
M:	P01246	bar			WT4S	GEODETIC PRESSURE
N:	P01247	bar			WT4S	TOTAL TANK BOTTOM PRESSURE
O:						
P:	Z01268	DEG			WT4S	TANK CLEANING UPPER LIMIT
Q:	Z01269	DEG			WT4S	TANK CLEANING LOWER LIMIT
R:						
S:						
T:						

2.115 Page:0320 M** CARGO TANK WT-4-P MAIN VARIABLES

A:						
B:	U01312	m	L=0.5	H=25.0	WT4P	TANK ULLAGE (measured)
C:						
D:	L01311	m			WT4P	SOUNDING (even keel)
E:	U01310	m			WT4P	TANK ULLAGE (even keel)
F:	V01302	%			WT4P	TANK VOLUME (cap. 14514 m3)
G:	V01301	m3			WT4P	TOTAL TANK LIQUID VOLUME
H:	M01303	tonn			WT4P	TOTAL TANK MASS (incl residues)
I:	M01305	tonn			WT4P	TOTAL RESIDUES IN TANK
J:						
K:	G01350	m3/h			WT4P	TOTAL BOTTOM OUTLET FLOW
L:						
M:	G01367	m3/h			WT4P	TANK CLEANING (SWW or COW) FLOW
N:						
O:	P01326	bar	L=-0.1	H=0.1	WT4P	TANK ATMOSPHERIC PRESSURE
P:	X01327	%	L=0.0	H=8.0	WT4P	OXYGEN CONTENT
Q:	X01330	%			WT4P	HYDRO CARBON CONTENT
R:						
S:	T01353	degC	L=40.0	H=100.0	WT4P	CARGO TEMPERATURE
T:						

2.116 Page:0321 M** CARGO TANK WT-4-P VALVES

A:				
B:				
C:				
D:	V01336	<0-1>	WT4P	BOTTOM VALVE - CNTR
E:	V01337	%	WT4P	BOTTOM VALVE - STBD
F:				
G:				
H:	V01364	<0-1>	WT4P	COW SUPPLY VALVE
I:				
J:				
K:	V01361	<0-1>	WT4P	INERT GAS SUPPLY VALVE
L:	V01362	<0-1>	WT4P	INERT GAS OUTLET VALVE (P/V bypass)
M:	V01363	<0-1>	WT4P	INERT GAS P/V VALVE
N:				
O:				
P:				
Q:				
R:				
S:				
T:				

2.117 Page:0322 M** CARGO TANK WT-4-P FLOWS

A:					
B:					
C:	G01341	m3/h			WT4P BOTTOM OUTLET FLOW - CNTR SUCTION
D:	G01342	m3/h			WT4P BOTTOM OUTLET FLOW - STBD SUCTION
E:					
F:					
G:	G01317	m3/s	L=0.0	H=1.0	WT4P TANK TOP OVERFLOW
H:					
I:	G01343	m3/h			WT4P COW CLEANING FLOW
J:	G01344	m3/h			WT4P SWW CLEANING FLOW
K:					
L:	G01333	m3/h			WT4P INERT GAS FLOW FROM MAIN LINE
M:	G01334	m3/h			WT4P INERT GAS FLOW TO DECK
N:					
O:	G01370	%			WT4P TOTAL SUCTION BOBBLE FLOW
P:					
Q:					
R:					
S:					
T:					

2.118 Page:0323 M** CARGO TANK WT-4-P LEVELS/MASSES

A:	U01310	m	WT4P TANK ULLAGE (even keel)
B:	L01311	m	WT4P SOUNDING (even keel)
C:			
D:	L01313	m	WT4P CLEAN OIL INTERFACE LEVEL
E:	L01314	m	WT4P CLEAN WTR INTERFACE LEVEL
F:	X01316	%	WT4P OIL CONTENT IN WTR/OIL MIXTURE
G:			
H:	M01303	tonn	WT4P TOTAL TANK MASS (incl residues)
I:	V01302	%	WT4P TANK VOLUME (cap. 14514 m3)
J:			
K:	M01322	tonn	WT4P CLEAN OIL MASS
L:	M01323	tonn	WT4P DIRTY OIL MASS
M:	M01324	tonn	WT4P DIRTY WATER MASS
N:	M01325	tonn	WT4P CLEAN WATER MASS
O:	M01307	tonn	WT4P HARD RESIDUES
P:	M01306	tonn	WT4P SOFT RESIDUES
Q:	M01315	tonn	WT4P DRIP RESIDUES
R:			
S:	D01320	kg/m3	WT4P OIL DENSITY (at 15 dgrC)
T:	D01321	kg/m3	WT4P WTR DENSITY (at 15 dgrC)

2.119 Page:0324 M** CARGO TANK WT-4-P HEATING

A:						
B:						
C:						
D:	T01353	degC	L=40.0	H=100.0	WT4P	CARGO TEMPERATURE
E:						
F:	V01356	%			WT4P	CARGO HEATING STEAM VALVE
G:	G01357	m3/h			WT4P	CARGO HEATING STEAM FLOW
H:						
I:	E01360	kW			WT4P	HEAT FROM STEAM
J:	E01354	kW			WT4P	HEAT LOSS TO SEA/AIR
K:	E01355	kW			WT4P	HEAT LOSS TO ADJACENT TANKS
L:						
M:						
N:						
O:						
P:						
Q:						
R:						
S:						
T:						

2.120 Page:0325 M** CARGO TANK WT-4-P MISCELLANEOUS

A:						
B:	Z01372	<0-2>			WT4P	IG INITIATION (1=air , 2=IG)
C:						
D:						
E:	P01326	bar	L=-0.1	H=0.1	WT4P	TANK ATMOSPHERIC PRESSURE
F:	X01327	%	L=0.0	H=8.0	WT4P	OXYGEN CONTENT
G:	X01330	%			WT4P	HYDRO CARBON CONTENT
H:						
I:	M01331	kg			WT4P	INERT GAS MASS (O2+CO2+N2)
J:	M01332	kg			WT4P	HYDRO CARBON MASS
K:						
L:	P01345	bar			WT4P	LIQUID+GAS PRESSURE
M:	P01346	bar			WT4P	GEODETIC PRESSURE
N:	P01347	bar			WT4P	TOTAL TANK BOTTOM PRESSURE
O:						
P:	Z01368	DEG			WT4P	TANK CLEANING UPPER LIMIT
Q:	Z01369	DEG			WT4P	TANK CLEANING LOWER LIMIT
R:						
S:						
T:						

2.121 Page:0400 M** CARGO TANK CT-4 MAIN VARIABLES

A:						
B:	U01412	m	L=0.5	H=25.0	CT4	TANK ULLAGE (measured)
C:						
D:	L01411	m			CT4	SOUNDING (even keel)
E:	U01410	m			CT4	TANK ULLAGE (even keel)
F:	V01402	%			CT4	TANK VOLUME (cap. 30806 m3)
G:	V01401	m3			CT4	TOTAL TANK LIQUID VOLUME
H:	M01403	tonn			CT4	TOTAL TANK MASS (incl residues)
I:	M01405	tonn			CT4	TOTAL RESIDUES IN TANK
J:						
K:	G01450	m3/h			CT4	TOTAL BOTTOM OUTLET FLOW
L:						
M:	G01467	m3/h			CT4	TANK CLEANING (SWW or COW) FLOW
N:						
O:	P01426	bar	L=-0.1	H=0.1	CT4	TANK ATMOSPHERIC PRESSURE
P:	X01427	%	L=0.0	H=8.0	CT4	OXYGEN CONTENT
Q:	X01430	%			CT4	HYDRO CARBON CONTENT
R:						
S:	T01453	degC	L=40.0	H=100.0	CT4	CARGO TEMPERATURE
T:						

2.122 Page:0401 M** CARGO TANK CT-4 VALVES

A:				
B:				
C:	V01436	<0-1>	CT4	BOTTOM VALVE - CNTR
D:	V01435	%	CT4	BOTTOM VALVE - PORT
E:	V01437	%	CT4	BOTTOM VALVE - STBD
F:				
G:				
H:	V01464	<0-1>	CT4	COW SUPPLY VALVE
I:				
J:				
K:	V01461	<0-1>	CT4	INERT GAS SUPPLY VALVE
L:	V01462	<0-1>	CT4	INERT GAS OUTLET VALVE (P/V bypass)
M:	V01463	<0-1>	CT4	INERT GAS P/V VALVE
N:				
O:				
P:				
Q:				
R:				
S:				
T:				

2.123 Page:0402 M** CARGO TANK CT-4 FLOWS

A:					
B:	G01441	m3/h			CT4 BOTTOM OUTLET FLOW - CNTR SUCTION
C:	G01440	m3/h			CT4 BOTTOM OUTLET FLOW - PORT SUCTION
D:	G01442	m3/h			CT4 BOTTOM OUTLET FLOW - STBD SUCTION
E:	G03263	m3/h			BW DROP FLOW INTO TANK (CT4)
F:					
G:	G01417	m3/s	L=0.0	H=1.0	CT4 TANK TOP OVERFLOW
H:					
I:	G01443	m3/h			CT4 COW CLEANING FLOW
J:	G01444	m3/h			CT4 SWW CLEANING FLOW
K:					
L:	G01433	m3/h			CT4 INERT GAS FLOW FROM MAIN LINE
M:	G01434	m3/h			CT4 INERT GAS FLOW TO DECK
N:					
O:	G01470	%			CT4 TOTAL SUCTION BOBBLE FLOW
P:					
Q:					
R:					
S:					
T:					

2.124 Page:0403 M** CARGO TANK CT-4 LEVELS/MASSES

A:	U01410	m	CT4 TANK ULLAGE (even keel)
B:	L01411	m	CT4 SOUNDING (even keel)
C:			
D:	L01413	m	CT4 CLEAN OIL INTERFACE LEVEL
E:	L01414	m	CT4 CLEAN WTR INTERFACE LEVEL
F:	X01416	%	CT4 OIL CONTENT IN WTR/OIL MIXTURE
G:			
H:	M01403	tonn	CT4 TOTAL TANK MASS (incl residues)
I:	V01402	%	CT4 TANK VOLUME (cap. 30806 m3)
J:			
K:	M01422	tonn	CT4 CLEAN OIL MASS
L:	M01423	tonn	CT4 DIRTY OIL MASS
M:	M01424	tonn	CT4 DIRTY WATER MASS
N:	M01425	tonn	CT4 CLEAN WATER MASS
O:	M01407	tonn	CT4 HARD RESIDUES
P:	M01406	tonn	CT4 SOFT RESIDUES
Q:	M01415	tonn	CT4 DRIP RESIDUES
R:			
S:	D01420	kg/m3	CT4 OIL DENSITY (at 15 dgrC)
T:	D01421	kg/m3	CT4 WTR DENSITY (at 15 dgrC)

2.125 Page:0404 M** CARGO TANK CT-4 HEATING

A:						
B:						
C:						
D:	T01453	degC	L=40.0	H=100.0	CT4	CARGO TEMPERATURE
E:						
F:	V01456	%			CT4	CARGO HEATING STEAM VALVE
G:	G01457	m3/h			CT4	CARGO HEATING STEAM FLOW
H:						
I:	E01460	kW			CT4	HEAT FROM STEAM
J:	E01454	kW			CT4	HEAT LOSS TO SEA/AIR
K:	E01455	kW			CT4	HEAT LOSS TO ADJACENT TANKS
L:						
M:						
N:						
O:						
P:						
Q:						
R:						
S:						
T:						

2.126 Page:0405 M** CARGO TANK CT-4 MISCELLANEOUS

A:						
B:	Z01472	<0-2>			CT4	IG INITIATION (1=air , 2=IG)
C:						
D:						
E:	P01426	bar	L=-0.1	H=0.1	CT4	TANK ATMOSPHERIC PRESSURE
F:	X01427	%	L=0.0	H=8.0	CT4	OXYGEN CONTENT
G:	X01430	%			CT4	HYDRO CARBON CONTENT
H:						
I:	M01431	kg			CT4	INERT GAS MASS (O2+CO2+N2)
J:	M01432	kg			CT4	HYDRO CARBON MASS
K:						
L:	P01445	bar			CT4	LIQUID+GAS PRESSURE
M:	P01446	bar			CT4	GEODETIC PRESSURE
N:	P01447	bar			CT4	TOTAL TANK BOTTOM PRESSURE
O:						
P:	Z01468	DEG			CT4	TANK CLEANING UPPER LIMIT
Q:	Z01469	DEG			CT4	TANK CLEANING LOWER LIMIT
R:						
S:						
T:						

2.127 Page:0410 M** CARGO TANK WT-5-S MAIN VARIABLES

A:					
B:	U01512	m	L=0.5	H=25.0	WT5S TANK ULLAGE (measured)
C:					
D:	L01511	m			WT5S SOUNDING (even keel)
E:	U01510	m			WT5S TANK ULLAGE (even keel)
F:	V01502	%			WT5S TANK VOLUME (cap. 8808 m3)
G:	V01501	m3			WT5S TOTAL TANK LIQUID VOLUME
H:	M01503	tonn			WT5S TOTAL TANK MASS (incl residues)
I:	M01505	tonn			WT5S TOTAL RESIDUES IN TANK
J:					
K:	G01550	m3/h			WT5S TOTAL BOTTOM OUTLET FLOW
L:					
M:	G01567	m3/h			WT5S TANK CLEANING (SWW or COW) FLOW
N:					
O:	P01526	bar	L=-0.1	H=0.1	WT5S TANK ATMOSPHERIC PRESSURE
P:	X01527	%	L=0.0	H=8.0	WT5S OXYGEN CONTENT
Q:	X01530	%			WT5S HYDRO CARBON CONTENT
R:					
S:	T01553	degC	L=40.0	H=100.0	WT5S CARGO TEMPERATURE
T:					

2.128 Page:0411 M** CARGO TANK WT-5-S VALVES

A:			
B:			
C:	V01536	<0-1>	WT5S BOTTOM VALVE - CNTR
D:	V01535	%	WT5S BOTTOM VALVE - PORT
E:			
F:			
G:	V01564	<0-1>	WT5S COW SUPPLY VALVE
H:	V01568	<0-1>	WT5S COW SUPPLY VALVE
I:			
J:	V01561	<0-1>	WT5S INERT GAS SUPPLY VALVE
K:	V01562	<0-1>	WT5S INERT GAS OUTLET VALVE (P/V bypass)
L:	V01563	<0-1>	WT5S INERT GAS P/V VALVE
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.129 Page:0412 M** CARGO TANK WT-5-S FLOWS

A:				
B: G01541	m3/h			WT5S BOTTOM OUTLET FLOW - CNTR SUCTION
C: G01540	m3/h			WT5S BOTTOM OUTLET FLOW - PORT SUCTION
D: G03264	m3/h			BW DROP FLOW INTO TANK (WT5S)
E:				
F: G01517	m3/s	L=0.0	H=1.0	WT5S TANK TOP OVERFLOW
G:				
H: G01543	m3/h			WT5S COW CLEANING FLOW
I: G01544	m3/h			WT5S SWW CLEANING FLOW
J:				
K: G01533	m3/h			WT5S INERT GAS FLOW FROM MAIN LINE
L: G01534	m3/h			WT5S INERT GAS FLOW TO DECK
M:				
N: G01570	%			WT5S TOTAL SUCTION BOBBLE FLOW
O:				
P:				
Q:				
R:				
S:				
T:				

2.130 Page:0413 M** CARGO TANK WT-5-S LEVELS/MASSES

A: U01510	m	WT5S TANK ULLAGE (even keel)
B: L01511	m	WT5S SOUNDING (even keel)
C:		
D: L01513	m	WT5S CLEAN OIL INTERFACE LEVEL
E: L01514	m	WT5S CLEAN WTR INTERFACE LEVEL
F: X01516	%	WT5S OIL CONTENT IN WTR/OIL MIXTURE
G:		
H: M01503	tonn	WT5S TOTAL TANK MASS (incl residues)
I: V01502	%	WT5S TANK VOLUME (cap. 8808 m3)
J:		
K: M01522	tonn	WT5S CLEAN OIL MASS
L: M01523	tonn	WT5S DIRTY OIL MASS
M: M01524	tonn	WT5S DIRTY WATER MASS
N: M01525	tonn	WT5S CLEAN WATER MASS
O: M01507	tonn	WT5S HARD RESIDUES
P: M01506	tonn	WT5S SOFT RESIDUES
Q: M01515	tonn	WT5S DRIP RESIDUES
R:		
S: D01520	kg/m3	WT5S OIL DENSITY (at 15 dgrC)
T: D01521	kg/m3	WT5S WTR DENSITY (at 15 dgrC)

2.131 Page:0414 M** CARGO TANK WT-5-S HEATING

A:					
B:					
C:					
D: T01553	degC	L=40.0	H=100.0	WT5S	CARGO TEMPERATURE
E:					
F: V01556	%			WT5S	CARGO HEATING STEAM VALVE
G: G01557	m3/h			WT5S	CARGO HEATING STEAM FLOW
H:					
I: E01560	kW			WT5S	HEAT FROM STEAM
J: E01554	kW			WT5S	HEAT LOSS TO SEA/AIR
K: E01555	kW			WT5S	HEAT LOSS TO ADJACENT TANKS
L:					
M:					
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.132 Page:0415 M** CARGO TANK WT-5-S MISCELLANEOUS

A:					
B: Z01572	<0-2>			WT5S	IG INITIATION (1=air , 2=IG)
C:					
D:					
E: P01526	bar	L=-0.1	H=0.1	WT5S	TANK ATMOSPHERIC PRESSURE
F: X01527	%	L=0.0	H=8.0	WT5S	OXYGEN CONTENT
G: X01530	%			WT5S	HYDRO CARBON CONTENT
H:					
I: M01531	kg			WT5S	INERT GAS MASS (O2+CO2+N2)
J: M01532	kg			WT5S	HYDRO CARBON MASS
K:					
L: P01545	bar			WT5S	LIQUID+GAS PRESSURE
M: P01546	bar			WT5S	GEODETIC PRESSURE
N: P01547	bar			WT5S	TOTAL TANK BOTTOM PRESSURE
O:					
P: Z01568	DEG			WT5S	TANK CLEANING UPPER LIMIT
Q: Z01569	DEG			WT5S	TANK CLEANING LOWER LIMIT
R:					
S:					
T:					

2.133 Page:0420 M** CARGO TANK WT-5-P MAIN VARIABLES

A:					
B: U01612	m	L=0.5	H=25.0	WT5P	TANK ULLAGE (measured)
C:					
D: L01611	m			WT5P	SOUNDING (even keel)
E: U01610	m			WT5P	TANK ULLAGE (even keel)
F: V01602	%			WT5P	TANK VOLUME (cap. 8808 m3)
G: V01601	m3			WT5P	TOTAL TANK LIQUID VOLUME
H: M01603	tonn			WT5P	TOTAL TANK MASS (incl residues)
I: M01605	tonn			WT5P	TOTAL RESIDUES IN TANK
J:					
K: G01650	m3/h			WT5P	TOTAL BOTTOM OUTLET FLOW
L:					
M: G01667	m3/h			WT5P	TANK CLEANING (SWW or COW) FLOW
N:					
O: P01626	bar	L=-0.1	H=0.1	WT5P	TANK ATMOSPHERIC PRESSURE
P: X01627	%	L=0.0	H=8.0	WT5P	OXYGEN CONTENT
Q: X01630	%			WT5P	HYDRO CARBON CONTENT
R:					
S: T01653	degC	L=40.0	H=100.0	WT5P	CARGO TEMPERATURE
T:					

2.134 Page:0421 M** CARGO TANK WT-5-P VALVES

A:			
B:			
C:			
D: V01636	<0-1>	WT5P	BOTTOM VALVE - CNTR
E: V01637	%	WT5P	BOTTOM VALVE - STBD
F:			
G:			
H: V01664	<0-1>	WT5P	COW SUPPLY VALVE
I: V01668	<0-1>	WT5P	COW SUPPLY VALVE
J:			
K: V01661	<0-1>	WT5P	INERT GAS SUPPLY VALVE
L: V01662	<0-1>	WT5P	INERT GAS OUTLET VALVE (P/V bypass)
M: V01663	<0-1>	WT5P	INERT GAS P/V VALVE
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.135 Page:0422 M** CARGO TANK WT-5-P FLOWS

A:					
B:	G01641	m3/h			WT5P BOTTOM OUTLET FLOW - CNTR SUCTION
C:					
D:	G01642	m3/h			WT5P BOTTOM OUTLET FLOW - STBD SUCTION
E:	G03265	m3/h			BW DROP FLOW INTO TANK (WT5P)
F:					
G:	G01617	m3/s	L=0.0	H=1.0	WT5P TANK TOP OVERFLOW
H:					
I:	G01643	m3/h			WT5P COW CLEANING FLOW
J:	G01644	m3/h			WT5P SWW CLEANING FLOW
K:					
L:	G01633	m3/h			WT5P INERT GAS FLOW FROM MAIN LINE
M:	G01634	m3/h			WT5P INERT GAS FLOW TO DECK
N:					
O:	G01670	%			WT5P TOTAL SUCTION BOBBLE FLOW
P:					
Q:					
R:					
S:					
T:					

2.136 Page:0423 M** CARGO TANK WT-5-P LEVELS/MASSES

A:	U01610	m	WT5P TANK ULLAGE (even keel)
B:	L01611	m	WT5P SOUNDING (even keel)
C:			
D:	L01613	m	WT5P CLEAN OIL INTERFACE LEVEL
E:	L01614	m	WT5P CLEAN WTR INTERFACE LEVEL
F:	X01616	%	WT5P OIL CONTENT IN WTR/OIL MIXTURE
G:			
H:	M01603	tonn	WT5P TOTAL TANK MASS (incl residues)
I:	V01602	%	WT5P TANK VOLUME (cap. 8808 m3)
J:			
K:	M01622	tonn	WT5P CLEAN OIL MASS
L:	M01623	tonn	WT5P DIRTY OIL MASS
M:	M01624	tonn	WT5P DIRTY WATER MASS
N:	M01625	tonn	WT5P CLEAN WATER MASS
O:	M01607	tonn	WT5P HARD RESIDUES
P:	M01606	tonn	WT5P SOFT RESIDUES
Q:	M01615	tonn	WT5P DRIP RESIDUES
R:			
S:	D01620	kg/m3	WT5P OIL DENSITY (at 15 dgrC)
T:	D01621	kg/m3	WT5P WTR DENSITY (at 15 dgrC)

2.137 Page:0424 M** CARGO TANK WT-5-P HEATING

A:					
B:					
C:					
D:	T01653	degC	L=40.0	H=100.0	WT5P CARGO TEMPERATURE
E:					
F:	V01656	%			WT5P CARGO HEATING STEAM VALVE
G:	G01657	m3/h			WT5P CARGO HEATING STEAM FLOW
H:					
I:	E01660	kW			WT5P HEAT FROM STEAM
J:	E01654	kW			WT5P HEAT LOSS TO SEA/AIR
K:	E01655	kW			WT5P HEAT LOSS TO ADJACENT TANKS
L:					
M:					
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.138 Page:0425 M** CARGO TANK WT-5-P MISCELLANEOUS

A:					
B:	Z01672	<0-2>			WT5P IG INITIATION (1=air , 2=IG)
C:					
D:					
E:	P01626	bar	L=-0.1	H=0.1	WT5P TANK ATMOSPHERIC PRESSURE
F:	X01627	%	L=0.0	H=8.0	WT5P OXYGEN CONTENT
G:	X01630	%			WT5P HYDRO CARBON CONTENT
H:					
I:	M01631	kg			WT5P INERT GAS MASS (O2+CO2+N2)
J:	M01632	kg			WT5P HYDRO CARBON MASS
K:					
L:	P01645	bar			WT5P LIQUID+GAS PRESSURE
M:	P01646	bar			WT5P GEODETIC PRESSURE
N:	P01647	bar			WT5P TOTAL TANK BOTTOM PRESSURE
O:					
P:	Z01668	DEG			WT5P TANK CLEANING UPPER LIMIT
Q:	Z01669	DEG			WT5P TANK CLEANING LOWER LIMIT
R:					
S:					
T:					

2.139 Page:0430 M** CARGO TANK WT-6-S MAIN VARIABLES

A:						
B:	U01712	m	L=0.5	H=25.0	WT6S	TANK ULLAGE (measured)
C:						
D:	L01711	m			WT6S	SOUNDING (even keel)
E:	U01710	m			WT6S	TANK ULLAGE (even keel)
F:	V01702	%			WT6S	TANK VOLUME (cap. 4024 m3)
G:	V01701	m3			WT6S	TOTAL TANK LIQUID VOLUME
H:	M01703	tonn			WT6S	TOTAL TANK MASS (incl residues)
I:	M01705	tonn			WT6S	TOTAL RESIDUES IN TANK
J:						
K:	G01750	m3/h			WT6S	TOTAL BOTTOM OUTLET FLOW
L:						
M:	G01767	m3/h			WT6S	TANK CLEANING (SWW or COW) FLOW
N:						
O:	P01726	bar	L=-0.1	H=0.1	WT6S	TANK ATMOSPHERIC PRESSURE
P:	X01727	%	L=0.0	H=8.0	WT6S	OXYGEN CONTENT
Q:	X01730	%			WT6S	HYDRO CARBON CONTENT
R:						
S:	T01753	degC	L=40.0	H=100.0	WT6S	CARGO TEMPERATURE
T:						

2.140 Page:0431 M** CARGO TANK WT-6-S VALVES

A:				
B:				
C:	V01736	<0-1>	WT6S	BOTTOM VALVE - CNTR
D:	V01735	%	WT6S	BOTTOM VALVE - PORT
E:				
F:				
G:				
H:	V01764	<0-1>	WT6S	COW SUPPLY VALVE
I:				
J:				
K:	V01761	<0-1>	WT6S	INERT GAS SUPPLY VALVE
L:	V01762	<0-1>	WT6S	INERT GAS OUTLET VALVE (P/V bypass)
M:	V01763	<0-1>	WT6S	INERT GAS P/V VALVE
N:				
O:				
P:				
Q:				
R:				
S:				
T:				

2.141 Page:0432 M** CARGO TANK WT-6-S FLOWS

A:				
B: G01741	m3/h			WT6S BOTTOM OUTLET FLOW - CNTR SUCTION
C: G01740	m3/h			WT6S BOTTOM OUTLET FLOW - PORT SUCTION
D:				
E:				
F: G03470	m3/h			SLOP SEPARATOR SUCTION FLOW
G: G03450	m3/h			BALANCE FLOW FROM PORT TO STBD SLOPT
H:				
I: G01717	m3/s	L=0.0	H=1.0	WT6S TANK TOP OVERFLOW
J:				
K: G01743	m3/h			WT6S COW CLEANING FLOW
L: G01744	m3/h			WT6S SWW CLEANING FLOW
M:				
N: G01733	m3/h			WT6S INERT GAS FLOW FROM MAIN LINE
O: G01734	m3/h			WT6S INERT GAS FLOW TO DECK
P:				
Q: G01770	%			WT6S TOTAL SUCTION BOBBLE FLOW
R:				
S:				
T:				

2.142 Page:0433 M** CARGO TANK WT-6-S LEVELS/MASSES

A: U01710	m	WT6S TANK ULLAGE (even keel)
B: L01711	m	WT6S SOUNDING (even keel)
C:		
D: L01713	m	WT6S CLEAN OIL INTERFACE LEVEL
E: L01714	m	WT6S CLEAN WTR INTERFACE LEVEL
F: X01716	%	WT6S OIL CONTENT IN WTR/OIL MIXTURE
G:		
H: M01703	tonn	WT6S TOTAL TANK MASS (incl residues)
I: V01702	%	WT6S TANK VOLUME (cap. 4024 m3)
J:		
K: M01722	tonn	WT6S CLEAN OIL MASS
L: M01723	tonn	WT6S DIRTY OIL MASS
M: M01724	tonn	WT6S DIRTY WATER MASS
N: M01725	tonn	WT6S CLEAN WATER MASS
O: M01707	tonn	WT6S HARD RESIDUES
P: M01706	tonn	WT6S SOFT RESIDUES
Q: M01715	tonn	WT6S DRIP RESIDUES
R:		
S: D01720	kg/m3	WT6S OIL DENSITY (at 15 dgrC)
T: D01721	kg/m3	WT6S WTR DENSITY (at 15 dgrC)

2.143 Page:0434 M** CARGO TANK WT-6-S HEATING

A:
B:
C:
D: T01753 degC L=40.0 H=100.0 WT6S CARGO TEMPERATURE
E:
F: V01756 % WT6S CARGO HEATING STEAM VALVE
G: G01757 m3/h WT6S CARGO HEATING STEAM FLOW
H:
I: E01760 kW WT6S HEAT FROM STEAM
J: E01754 kW WT6S HEAT LOSS TO SEA/AIR
K: E01755 kW WT6S HEAT LOSS TO ADJACENT TANKS
L:
M:
N:
O:
P:
Q:
R:
S:
T:

2.144 Page:0435 M** CARGO TANK WT-6-S MISCELLANEOUS

A:
B: Z01772 <0-2> WT6S IG INITIATION (1=air , 2=IG)
C:
D:
E: P01726 bar L=-0.1 H=0.1 WT6S TANK ATMOSPHERIC PRESSURE
F: X01727 % L=0.0 H=8.0 WT6S OXYGEN CONTENT
G: X01730 % WT6S HYDRO CARBON CONTENT
H:
I: M01731 kg WT6S INERT GAS MASS (O2+CO2+N2)
J: M01732 kg WT6S HYDRO CARBON MASS
K:
L: P01745 bar WT6S LIQUID+GAS PRESSURE
M: P01746 bar WT6S GEODETIC PRESSURE
N: P01747 bar WT6S TOTAL TANK BOTTOM PRESSURE
O:
P: Z01768 DEG WT6S TANK CLEANING UPPER LIMIT
Q: Z01769 DEG WT6S TANK CLEANING LOWER LIMIT
R:
S:
T:

2.145 Page:0440 M** CARGO TANK WT-6-P MAIN VARIABLES

A:					
B:	U02012	m	L=0.5	H=25.0	WT6P TANK ULLAGE (measured)
C:					
D:	L02011	m			WT6P SOUNDING (even keel)
E:	U02010	m			WT6P TANK ULLAGE (even keel)
F:	V02002	%			WT6P TANK VOLUME (cap. 4024 m3)
G:	V02001	m3			WT6P TOTAL TANK LIQUID VOLUME
H:	M02003	tonn			WT6P TOTAL TANK MASS (incl residues)
I:	M02005	tonn			WT6P TOTAL RESIDUES IN TANK
J:					
K:	G02050	m3/h			WT6P TOTAL BOTTOM OUTLET FLOW
L:					
M:	G02067	m3/h			WT6P TANK CLEANING (SWW or COW) FLOW
N:					
O:	P02026	bar	L=-0.1	H=0.1	WT6P TANK ATMOSPHERIC PRESSURE
P:	X02027	%	L=0.0	H=8.0	WT6P OXYGEN CONTENT
Q:	X02030	%			WT6P HYDRO CARBON CONTENT
R:					
S:	T02053	degC	L=40.0	H=100.0	WT6P CARGO TEMPERATURE
T:					

2.146 Page:0441 M** CARGO TANK WT-6-P VALVES

A:			
B:			
C:			
D:	V02036	<0-1>	WT6P BOTTOM VALVE - CNTR
E:	V02037	%	WT6P BOTTOM VALVE - STBD
F:			
G:			
H:	V02064	<0-1>	WT6P COW SUPPLY VALVE
I:			
J:			
K:	V02061	<0-1>	WT6P INERT GAS SUPPLY VALVE
L:	V02062	<0-1>	WT6P INERT GAS OUTLET VALVE (P/V bypass)
M:	V02063	<0-1>	WT6P INERT GAS P/V VALVE
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.147 Page:0442 M** CARGO TANK WT-6-P FLOWS

A:				
B:	G02041	m3/h		WT6P BOTTOM OUTLET FLOW - CNTR SUCTION
C:	G02042	m3/h		WT6P BOTTOM OUTLET FLOW - STBD SUCTION
D:				
E:	G03371	m3/h		DIRTY BALLAST DISCHARGE TO SLOPT(P)
F:	G03370	m3/h		FLOW FROM SLOPC TO ODM
G:	G03472	m3/h		DIRTY (oily) DISCHARGE FLOW
H:	G03450	m3/h		BALANCE FLOW FROM PORT TO STBD SLOPT
I:	G03460	m3/h		EQUALIZING FLOW FROM SLOPT(P) TO CT4
J:	G03345	m3/h		EDUCTOR DISCHARGE FLOW
K:				
L:	G02017	m3/s	L=0.0 H=1.0	WT6P TANK TOP OVERFLOW
M:				
N:	G02043	m3/h		WT6P COW CLEANING FLOW
O:	G02044	m3/h		WT6P SWW CLEANING FLOW
P:				
Q:	G02033	m3/h		WT6P INERT GAS FLOW FROM MAIN LINE
R:	G02034	m3/h		WT6P INERT GAS FLOW TO DECK
S:				
T:	G02070	%		WT6P TOTAL SUCTION BOBBLE FLOW

2.148 Page:0443 M** CARGO TANK WT-6-P LEVELS/MASSES

A:	U02010	m	WT6P TANK ULLAGE (even keel)
B:	L02011	m	WT6P SOUNDING (even keel)
C:			
D:	L02013	m	WT6P CLEAN OIL INTERFACE LEVEL
E:	L02014	m	WT6P CLEAN WTR INTERFACE LEVEL
F:	X02016	%	WT6P OIL CONTENT IN WTR/OIL MIXTURE
G:			
H:	M02003	tonn	WT6P TOTAL TANK MASS (incl residues)
I:	V02002	%	WT6P TANK VOLUME (cap. 4024 m3)
J:			
K:	M02022	tonn	WT6P CLEAN OIL MASS
L:	M02023	tonn	WT6P DIRTY OIL MASS
M:	M02024	tonn	WT6P DIRTY WATER MASS
N:	M02025	tonn	WT6P CLEAN WATER MASS
O:	M02007	tonn	WT6P HARD RESIDUES
P:	M02006	tonn	WT6P SOFT RESIDUES
Q:	M02015	tonn	WT6P DRIP RESIDUES
R:			
S:	D02020	kg/m3	WT6P OIL DENSITY (at 15 dgrC)
T:	D02021	kg/m3	WT6P WTR DENSITY (at 15 dgrC)

2.149 Page:0444 M** CARGO TANK WT-6-P HEATING

A:					
B:					
C:					
D: T02053	degC	L=40.0	H=100.0	WT6P	CARGO TEMPERATURE
E:					
F: V02056	%			WT6P	CARGO HEATING STEAM VALVE
G: G02057	m3/h			WT6P	CARGO HEATING STEAM FLOW
H:					
I: E02060	kW			WT6P	HEAT FROM STEAM
J: E02054	kW			WT6P	HEAT LOSS TO SEA/AIR
K: E02055	kW			WT6P	HEAT LOSS TO ADJACENT TANKS
L:					
M:					
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.150 Page:0445 M** CARGO TANK WT-6-P MISCELLANEOUS

A:					
B: Z02072	<0-2>			WT6P	IG INITIATION (1=air , 2=IG)
C:					
D:					
E: P02026	bar	L=-0.1	H=0.1	WT6P	TANK ATMOSPHERIC PRESSURE
F: X02027	%	L=0.0	H=8.0	WT6P	OXYGEN CONTENT
G: X02030	%			WT6P	HYDRO CARBON CONTENT
H:					
I: M02031	kg			WT6P	INERT GAS MASS (O2+CO2+N2)
J: M02032	kg			WT6P	HYDRO CARBON MASS
K:					
L: P02045	bar			WT6P	LIQUID+GAS PRESSURE
M: P02046	bar			WT6P	GEODETIC PRESSURE
N: P02047	bar			WT6P	TOTAL TANK BOTTOM PRESSURE
O:					
P: Z02068	DEG			WT6P	TANK CLEANING UPPER LIMIT
Q: Z02069	DEG			WT6P	TANK CLEANING LOWER LIMIT
R:					
S:					
T:					

2.151 Page:0500 M** TANK SURVEY SOUNDINGS

A:	L00011	m	FPT SOUNDING (even keel)
B:	L00111	m	CT1 SOUNDING (even keel)
C:	L00211	m	WT1S SOUNDING (even keel)
D:	L00311	m	WT1P SOUNDING (even keel)
E:	L00411	m	CT2 SOUNDING (even keel)
F:	L00511	m	WT2S SOUNDING (even keel)
G:	L00611	m	WT2P SOUNDING (even keel)
H:	L00711	m	WT3BS SOUNDING (even keel)
I:	L01011	m	WT3BP SOUNDING (even keel)
J:	L01111	m	CT3 SOUNDING (even keel)
K:	L01211	m	WT4S SOUNDING (even keel)
L:	L01311	m	WT4P SOUNDING (even keel)
M:	L01411	m	CT4 SOUNDING (even keel)
N:	L01511	m	WT5S SOUNDING (even keel)
O:	L01611	m	WT5P SOUNDING (even keel)
P:	L01711	m	WT6S SOUNDING (even keel)
Q:	L02011	m	WT6P SOUNDING (even keel)
R:			
S:	L04112	m	FORE HFO TANK SOUNDING
T:	L04122	m	AFT HFO TANK SOUNDING

2.152 Page:0501 M** TANK SURVEY MASSES

A:	M00003	tonn	FPT TOTAL TANK MASS (incl residues)
B:	M00103	tonn	CT1 TOTAL TANK MASS (incl residues)
C:	M00203	tonn	WT1S TOTAL TANK MASS (incl residues)
D:	M00303	tonn	WT1P TOTAL TANK MASS (incl residues)
E:	M00403	tonn	CT2 TOTAL TANK MASS (incl residues)
F:	M00503	tonn	WT2S TOTAL TANK MASS (incl residues)
G:	M00603	tonn	WT2P TOTAL TANK MASS (incl residues)
H:	M00704	tonn	WT3BS TOTAL TANK MASS (incl residues)
I:	M01004	tonn	WT3BP TOTAL TANK MASS (incl residues)
J:	M01103	tonn	CT3 TOTAL TANK MASS (incl residues)
K:	M01203	tonn	WT4S TOTAL TANK MASS (incl residues)
L:	M01303	tonn	WT4P TOTAL TANK MASS (incl residues)
M:	M01403	tonn	CT4 TOTAL TANK MASS (incl residues)
N:	M01503	tonn	WT5S TOTAL TANK MASS (incl residues)
O:	M01603	tonn	WT5P TOTAL TANK MASS (incl residues)
P:	M01703	tonn	WT6S TOTAL TANK MASS (incl residues)
Q:	M02003	tonn	WT6P TOTAL TANK MASS (incl residues)
R:			
S:	M04111	tonn	FORE HFO TANK MASS
T:	M04121	tonn	AFT HFO TANK MASS

2.153 Page:0502 M** TANK SURVEY VOLUMES

A:	V00001	m3	FPT TOTAL TANK LIQUID VOLUME
B:	V00101	m3	CT1 TOTAL TANK LIQUID VOLUME
C:	V00201	m3	WT1S TOTAL TANK LIQUID VOLUME
D:	V00301	m3	WT1P TOTAL TANK LIQUID VOLUME
E:	V00401	m3	CT2 TOTAL TANK LIQUID VOLUME
F:	V00501	m3	WT2S TOTAL TANK LIQUID VOLUME
G:	V00601	m3	WT2P TOTAL TANK LIQUID VOLUME
H:	V00701	m3	WT3BS TOTAL TANK LIQUID VOLUME
I:	V01001	m3	WT3BP TOTAL TANK LIQUID VOLUME
J:	V01101	m3	CT3 TOTAL TANK LIQUID VOLUME
K:	V01201	m3	WT4S TOTAL TANK LIQUID VOLUME
L:	V01301	m3	WT4P TOTAL TANK LIQUID VOLUME
M:	V01401	m3	CT4 TOTAL TANK LIQUID VOLUME
N:	V01501	m3	WT5S TOTAL TANK LIQUID VOLUME
O:	V01601	m3	WT5P TOTAL TANK LIQUID VOLUME
P:	V01701	m3	WT6S TOTAL TANK LIQUID VOLUME
Q:	V02001	m3	WT6P TOTAL TANK LIQUID VOLUME
R:			
S:			
T:			

2.154 Page:0503 M** TANK SURVEY RELATIVE VOLUMES

A:	V00002	%	FPT TANK VOLUME (cap. 12113 m3)
B:	V00102	%	CT1 TANK VOLUME (cap. 30813 m3)
C:	V00202	%	WT1S TANK VOLUME (cap. 12554 m3)
D:	V00302	%	WT1P TANK VOLUME (cap. 12554 m3)
E:	V00402	%	CT2 TANK VOLUME (cap. 30818 m3)
F:	V00502	%	WT2S TANK VOLUME (cap. 9283 m3)
G:	V00602	%	WT2P TANK VOLUME (cap. 9283 m3)
H:	V00702	%	WT3BS TANK VOLUME (cap. 5231 m3)
I:	V01002	%	WT3BP TANK VOLUME (cap. 5231 m3)
J:	V01102	%	CT3 TANK VOLUME (cap. 30818 m3)
K:	V01202	%	WT4S TANK VOLUME (cap. 14514 m3)
L:	V01302	%	WT4P TANK VOLUME (cap. 14514 m3)
M:	V01402	%	CT4 TANK VOLUME (cap. 30806 m3)
N:	V01502	%	WT5S TANK VOLUME (cap. 8808 m3)
O:	V01602	%	WT5P TANK VOLUME (cap. 8808 m3)
P:	V01702	%	WT6S TANK VOLUME (cap. 4024 m3)
Q:	V02002	%	WT6P TANK VOLUME (cap. 4024 m3)
R:			
S:	V04110	%	FORE HFO TANK VOLUME
T:	V04120	%	AFT HFO TANK VOLUME

2.155 Page:0504 M** TANK SURVEY TEMPERATURES

A:					
B:	T00153	degC	L=40.0	H=100.0	CT1 CARGO TEMPERATURE
C:	T00253	degC	L=40.0	H=100.0	WT1S CARGO TEMPERATURE
D:	T00353	degC	L=40.0	H=100.0	WT1P CARGO TEMPERATURE
E:	T00453	degC	L=40.0	H=100.0	CT2 CARGO TEMPERATURE
F:	T00553	degC	L=40.0	H=100.0	WT2S CARGO TEMPERATURE
G:	T00653	degC	L=40.0	H=100.0	WT2P CARGO TEMPERATURE
H:					
I:					
J:	T01153	degC	L=40.0	H=100.0	CT3 CARGO TEMPERATURE
K:	T01253	degC	L=40.0	H=100.0	WT4S CARGO TEMPERATURE
L:	T01353	degC	L=40.0	H=100.0	WT4P CARGO TEMPERATURE
M:	T01453	degC	L=40.0	H=100.0	CT4 CARGO TEMPERATURE
N:	T01553	degC	L=40.0	H=100.0	WT5S CARGO TEMPERATURE
O:	T01653	degC	L=40.0	H=100.0	WT5P CARGO TEMPERATURE
P:	T01753	degC	L=40.0	H=100.0	WT6S CARGO TEMPERATURE
Q:	T02053	degC	L=40.0	H=100.0	WT6P CARGO TEMPERATURE
R:					
S:					
T:					

2.156 Page:0505 M** TANK SURVEY RESIDUES

A:			
B:	M00105	tonn	CT1 TOTAL RESIDUES IN TANK
C:	M00205	tonn	WT1S TOTAL RESIDUES IN TANK
D:	M00305	tonn	WT1P TOTAL RESIDUES IN TANK
E:	M00405	tonn	CT2 TOTAL RESIDUES IN TANK
F:	M00505	tonn	WT2S TOTAL RESIDUES IN TANK
G:	M00605	tonn	WT2P TOTAL RESIDUES IN TANK
H:			
I:			
J:	M01105	tonn	CT3 TOTAL RESIDUES IN TANK
K:	M01205	tonn	WT4S TOTAL RESIDUES IN TANK
L:	M01305	tonn	WT4P TOTAL RESIDUES IN TANK
M:	M01405	tonn	CT4 TOTAL RESIDUES IN TANK
N:	M01505	tonn	WT5S TOTAL RESIDUES IN TANK
O:	M01605	tonn	WT5P TOTAL RESIDUES IN TANK
P:	M01705	tonn	WT6S TOTAL RESIDUES IN TANK
Q:	M02005	tonn	WT6P TOTAL RESIDUES IN TANK
R:			
S:	M04164	tonn	TOTAL TANK RESIDUE
T:			

2.157 Page:0506 M** TANK SURVEY ULLAGES

A:	U00010 m	FPT TANK ULLAGE (even keel)
B:	U00110 m	CT1 TANK ULLAGE (even keel)
C:	U00210 m	WT1S TANK ULLAGE (even keel)
D:	U00310 m	WT1P TANK ULLAGE (even keel)
E:	U00410 m	CT2 TANK ULLAGE (even keel)
F:	U00510 m	WT2S TANK ULLAGE (even keel)
G:	U00610 m	WT2P TANK ULLAGE (even keel)
H:	U00710 m	WT3BS TANK ULLAGE (even keel)
I:	U01010 m	WT3P TANK ULLAGE (even keel)
J:	U01110 m	CT3 TANK ULLAGE (even keel)
K:	U01210 m	WT4S TANK ULLAGE (even keel)
L:	U01310 m	WT4P TANK ULLAGE (even keel)
M:	U01410 m	CT4 TANK ULLAGE (even keel)
N:	U01510 m	WT5S TANK ULLAGE (even keel)
O:	U01610 m	WT5P TANK ULLAGE (even keel)
P:	U01710 m	WT6S TANK ULLAGE (even keel)
Q:	U02010 m	WT6P TANK ULLAGE (even keel)
R:		
S:		
T:		

2.158 Page:0507 M** TANK SURVEY ULLAGES (mes)

A:	U00012 m	L=0.5	H=25.0	FPT TANK ULLAGE (measured)
B:	U00112 m	L=0.5	H=25.0	CT1 TANK ULLAGE (measured)
C:	U00212 m	L=0.5	H=25.0	WT1S TANK ULLAGE (measured)
D:	U00312 m	L=0.5	H=25.0	WT1P TANK ULLAGE (measured)
E:	U00412 m	L=0.5	H=25.0	CT2 TANK ULLAGE (measured)
F:	U00512 m	L=0.5	H=25.0	WT2S TANK ULLAGE (measured)
G:	U00612 m	L=0.5	H=25.0	WT2P TANK ULLAGE (measured)
H:	U00712 m	L=0.5	H=25.0	WT3BS TANK ULLAGE (measured)
I:	U01012 m	L=0.5	H=25.0	WT3P TANK ULLAGE (measured)
J:	U01112 m	L=0.5	H=25.0	CT3 TANK ULLAGE (measured)
K:	U01212 m	L=0.5	H=25.0	WT4S TANK ULLAGE (measured)
L:	U01312 m	L=0.5	H=25.0	WT4P TANK ULLAGE (measured)
M:	U01412 m	L=0.5	H=25.0	CT4 TANK ULLAGE (measured)
N:	U01512 m	L=0.5	H=25.0	WT5S TANK ULLAGE (measured)
O:	U01612 m	L=0.5	H=25.0	WT5P TANK ULLAGE (measured)
P:	U01712 m	L=0.5	H=25.0	WT6S TANK ULLAGE (measured)
Q:	U02012 m	L=0.5	H=25.0	WT6P TANK ULLAGE (measured)
R:				
S:				
T:				

2.159 Page:0510 M** TANK COW VALVES

A:	V00164 <0-1>	CT1 COW SUPPLY VALVE
B:	V00264 <0-1>	WT1S COW SUPPLY VALVE
C:	V00364 <0-1>	WT1P COW SUPPLY VALVE
D:		
E:	V00464 <0-1>	CT2 COW SUPPLY VALVE
F:	V00564 <0-1>	WT2S COW SUPPLY VALVE
G:	V00568 <0-1>	WT2S COW SUPPLY VALVE
H:	V00664 <0-1>	WT2P COW SUPPLY VALVE
I:	V00668 <0-1>	WT2P COW SUPPLY VALVE
J:		
K:	V01164 <0-1>	CT3 COW SUPPLY VALVE
L:	V01264 <0-1>	WT4S COW SUPPLY VALVE
M:	V01364 <0-1>	WT4P COW SUPPLY VALVE
N:	V01464 <0-1>	CT4 COW SUPPLY VALVE
O:	V01564 <0-1>	WT5S COW SUPPLY VALVE
P:	V01568 <0-1>	WT5S COW SUPPLY VALVE
Q:	V01664 <0-1>	WT5P COW SUPPLY VALVE
R:	V01668 <0-1>	WT5P COW SUPPLY VALVE
S:	V01764 <0-1>	WT6S COW SUPPLY VALVE
T:	V02064 <0-1>	WT6P COW SUPPLY VALVE

2.160 Page:0512 M** P/V BYPASS VALVES

A:		
B:	V00162 <0-1>	CT1 INERT GAS OUTLET VALVE (P/V bypass)
C:	V00262 <0-1>	WT1S INERT GAS OUTLET VALVE (P/V bypass)
D:	V00362 <0-1>	WT1P INERT GAS OUTLET VALVE (P/V bypass)
E:		
F:	V00462 <0-1>	CT2 INERT GAS OUTLET VALVE (P/V bypass)
G:	V00562 <0-1>	WT2S INERT GAS OUTLET VALVE (P/V bypass)
H:	V00662 <0-1>	WT2P INERT GAS OUTLET VALVE (P/V bypass)
I:		
J:	V01162 <0-1>	CT3 INERT GAS OUTLET VALVE (P/V bypass)
K:		
L:	V01462 <0-1>	CT4 INERT GAS OUTLET VALVE (P/V bypass)
M:	V01262 <0-1>	WT4S INERT GAS OUTLET VALVE (P/V bypass)
N:	V01362 <0-1>	WT4P INERT GAS OUTLET VALVE (P/V bypass)
O:		
P:	V01562 <0-1>	WT5S INERT GAS OUTLET VALVE (P/V bypass)
Q:	V01662 <0-1>	WT5P INERT GAS OUTLET VALVE (P/V bypass)
R:	V01762 <0-1>	WT6S INERT GAS OUTLET VALVE (P/V bypass)
S:	V02062 <0-1>	WT6P INERT GAS OUTLET VALVE (P/V bypass)
T:		

2.161 Page:0520 M** PIPING OIL RESIDUES (1)

A:			
B:	X02175	%	PIPE LINE 1 OIL CONTENT (aft)
C:	X02205	%	PIPE LINE 1 OIL CONTENT (fore)
D:	X02150	%	DECK LINE 1 OIL CONTENT (aft)
E:	X02153	%	MANIFOLD 1 OIL CONTENT
F:			
G:	X02375	%	PIPE LINE 2 OIL CONTENT (aft)
H:	X02405	%	PIPE LINE 2 OIL CONTENT (fore)
I:	X02350	%	DECK LINE 2 OIL CONTENT (aft)
J:	X02353	%	MANIFOLD 2 OIL CONTENT
K:			
L:	X02575	%	PIPE LINE 3 OIL CONTENT (aft)
M:	X02605	%	PIPE LINE 3 OIL CONTENT (fore)
N:	X02550	%	DECK LINE 3 OIL CONTENT (aft)
O:	X02553	%	MANIFOLD 3 OIL CONTENT
P:			
Q:	X02775	%	PIPE LINE 4 OIL CONTENT (aft)
R:	X03005	%	PIPE LINE 4 OIL CONTENT (fore)
S:	X02750	%	DECK LINE 4 OIL CONTENT (aft)
T:	X02753	%	MANIFOLD 4 OIL CONTENT

2.162 Page:0521 M** PIPING OIL RESIDUES (2)

A:			
B:			
C:	X02124	%	COP1 SEPARATOR OIL CONTENT
D:	X02324	%	COP2 SEPARATOR OIL CONTENT
E:	X02524	%	COP3 SEPARATOR OIL CONTENT
F:	X02724	%	COP4 SEPARATOR OIL CONTENT
G:			
H:			
I:	X03354	%	CO SUCTION CROSSOVER OIL CONTENT
J:	X03355	%	SW SUCTION PORT CROSSOVER OIL CONTENT
K:	X03356	%	TC/COW CROSSOVER OIL CONTENT
L:	X03357	%	SLOP CROSSOVER OIL CONTENT
M:	X03359	%	SW SUCTION STBD CROSSOVER OIL CONTENT
N:			
O:			
P:	X03312	%	SMALL DIAM LINE OIL CONTENT
Q:			
R:	M04164	tonn	TOTAL TANK RESIDUE
S:			
T:			

2.163 Page:0600 M** HULL SHEAR FORCES

A:					
B:	P06000	ktonn	L=-20.0	H=20.0	SHEAR FORCE (section 0)
C:	P06001	ktonn	L=-16.0	H=16.0	SHEAR FORCE (section 1)
D:	P06002	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 2)
E:	P06003	ktonn	L=-20.0	H=20.0	SHEAR FORCE (section 3)
F:	P06004	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 4)
G:	P06005	ktonn	L=-16.0	H=16.0	SHEAR FORCE (section 5)
H:	P06006	ktonn	L=-16.0	H=16.0	SHEAR FORCE (section 6)
I:	P06007	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 7)
J:	P06010	ktonn	L=-22.0	H=22.0	SHEAR FORCE (section 8)
K:	P06011	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 9)
L:	P06012	ktonn	L=-14.0	H=14.0	SHEAR FORCE (section 10)
M:	P06013	ktonn	L=-12.0	H=12.0	SHEAR FORCE (section 11)
N:	P06014	ktonn	L=-20.0	H=20.0	SHEAR FORCE (section 12)
O:					
P:					
Q:					
R:					
S:					
T:					

2.164 Page:0601 M** HULL BENDING MOMENTS

A:					
B:	Q06020	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 0)
C:	Q06021	ktonm	L=-300.0	H=300.0	BENDING MOMENT (section 1)
D:	Q06022	ktonm	L=-350.0	H=350.0	BENDING MOMENT (section 2)
E:	Q06023	ktonm	L=-500.0	H=500.0	BENDING MOMENT (section 3)
F:	Q06024	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 4)
G:	Q06025	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 5)
H:	Q06026	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 6)
I:	Q06027	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 7)
J:	Q06030	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 8)
K:	Q06031	ktonm	L=-500.0	H=500.0	BENDING MOMENT (section 9)
L:	Q06032	ktonm	L=-200.0	H=200.0	BENDING MOMENT (section 10)
M:	Q06033	ktonm	L=-200.0	H=200.0	BENDING MOMENT (section 11)
N:	Q06034	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 12)
O:					
P:					
Q:					
R:					
S:					
T:					

2.165 Page:0602 M** HULL DEFLECTIONS

A:			
B:	L06040	m	HULL DEFLECTION (section 0)
C:	L06041	m	HULL DEFLECTION (section 1)
D:	L06042	m	HULL DEFLECTION (section 2)
E:	L06043	m	HULL DEFLECTION (section 3)
F:	L06044	m	HULL DEFLECTION (section 4)
G:	L06045	m	HULL DEFLECTION (section 5)
H:	L06046	m	HULL DEFLECTION (section 6)
I:	L06047	m	HULL DEFLECTION (section 7)
J:	L06050	m	HULL DEFLECTION (section 8)
K:	L06051	m	HULL DEFLECTION (section 9)
L:	L06052	m	HULL DEFLECTION (section 10)
M:	L06053	m	HULL DEFLECTION (section 11)
N:	L06054	m	HULL DEFLECTION (section 12)
O:			
P:			
Q:			
R:			
S:			
T:			

2.166 Page:0603 M** HULL STABILITY

A:			
B:	L06060	m	RIGHTING LEVER (GZ) (0 dgr)
C:	L06061	m	RIGHTING LEVER (GZ) (5 dgr)
D:	L06062	m	RIGHTING LEVER (GZ) (10 dgr)
E:	L06063	m	RIGHTING LEVER (GZ) (15 dgr)
F:	L06064	m	RIGHTING LEVER (GZ) (20 dgr)
G:	L06065	m	RIGHTING LEVER (GZ) (25 dgr)
H:	L06066	m	RIGHTING LEVER (GZ) (30 dgr)
I:	L06067	m	RIGHTING LEVER (GZ) (35 dgr)
J:	L06070	m	RIGHTING LEVER (GZ) (40 dgr)
K:	L06071	m	RIGHTING LEVER (GZ) (45 dgr)
L:	L06072	m	RIGHTING LEVER (GZ) (50 dgr)
M:	L06073	m	RIGHTING LEVER (GZ) (55 dgr)
N:	L06074	m	RIGHTING LEVER (GZ) (60 dgr)
O:			
P:	L06075	m	METACENTRIC HEIGHT (corrected)
Q:	L06076	m	FREE SURFACE (reduction)
R:	E06077	mrad	DYNAMIC STABILITY (area 0-40 dgr)
S:			
T:			

2.167 Page:0604 M** HULL DRAFT ++

A:	L04011	m			DRAFT AFT
B:	L04012	m			DRAFT FORE
C:	L04015	m			DRAFT STBD
D:	L04016	m			DRAFT PORT
E:					
F:	L04013	m			HULL TRIM
G:	L04014	m			HULL HEEL
H:					
I:	Z04166	%			DEADWEIGHT (relative)
J:	M04165	ktonn			DEADWEIGHT
K:	M04167	ktonn			DISPLACEMENT
L:					
M:					
N:	M04163	ktonn			TOTAL CARGO MASS
O:	M04150	tonn			TOTAL HFO MASS
P:	M04151	tonn			TOTAL DO MASS
Q:	M04152	tonn			TOTAL FW MASS
R:					
S:					
T:					

2.168 Page:0700 M** LOAD-MASTER : CONTROL

A:	X06799	<0-3>			INIT LOAD MASTER 1/2/3:EMPTY/REAL/LOADED
B:	X06798	<0-1>			TRANSFER LOAD MASTER DATA TO SIMULATOR
C:	D74001	kg/m3			SEA WATER DENSITY (Load-Master)
D:	T74000	degC			SEA WATER TEMP (Load-Master)
E:					
F:	U06784	m	L=0.0	H=0.0	COMMON ULLAGE SETTING (Load-Master)
G:	X06785	<0-1>			SET ULLAGE FOR ALL CARGO TANKS
H:	X06786	<0-1>			SET ULLAGE FOR ALL BALLAST TANKS
I:					
J:	V06787	%			COMMON VOLUME SETTING(Load-Master)
K:	X06788	<0-1>			SET VOLUME FOR ALL CARGO TANKS
L:	X06789	<0-1>			SET VOLUME FOR ALL BALLAST TANKS
M:					
N:	D06790	kg/m3			COMMON DENSITY SETTING (Load-Master)
O:	X06791	<0-1>			SET DENSITY FOR ALL CARGO TANKS
P:	X06792	<0-1>			SET DENSITY FOR ALL BALLAST TANKS
Q:					
R:	T06793	degC			COMMON TEMPERATURE SETTING (Load-Master)
S:	X06794	<0-1>			SET TEMPERATURE FOR ALL CARGO TANKS
T:	X06795	<0-1>			SET TEMPERATURE FOR ALL BALLAST TANKS

2.169 Page:0701 M** LOAD-MASTER : VOLUMES (inputs)

A:	V06730	%	FPT TANK VOLUME (Load-Master)
B:	V06731	%	CT1 TANK VOLUME (Load-Master)
C:	V06732	%	WT1S TANK VOLUME (Load-Master)
D:	V06733	%	WT1P TANK VOLUME (Load-Master)
E:	V06734	%	CT2 TANK VOLUME (Load-Master)
F:	V06735	%	WT2S TANK VOLUME (Load-Master)
G:	V06736	%	WT2P TANK VOLUME (Load-Master)
H:	V06737	%	WT3BS TANK VOLUME (Load-Master)
I:	V06740	%	WT3BP TANK VOLUME (Load-Master)
J:	V06741	%	CT3 TANK VOLUME (Load-Master)
K:	V06742	%	WT4S TANK VOLUME (Load-Master)
L:	V06743	%	WT4P TANK VOLUME (Load-Master)
M:	V06744	%	CT4 TANK VOLUME (Load-Master)
N:	V06745	%	WT5S TANK VOLUME (Load-Master)
O:	V06746	%	WT5P TANK VOLUME (Load-Master)
P:	V06747	%	WT6S TANK VOLUME (Load-Master)
Q:	V06750	%	WT6P TANK VOLUME (Load-Master)
R:	V06751	%	FHFO TANK VOLUME (Load-Master)
S:	V06752	%	AHFO TANK VOLUME (Load-Master)
T:			

2.170 Page:0702 M** LOAD-MASTER : DENSITIES (inputs)

A:	D06700	kg/m3	FPT LIQUID DENSITY (Load-Master)
B:	D06701	kg/m3	CT1 LIQUID DENSITY (Load-Master)
C:	D06702	kg/m3	WT1S LIQUID DENSITY (Load-Master)
D:	D06703	kg/m3	WT1P LIQUID DENSITY (Load-Master)
E:	D06704	kg/m3	CT2 LIQUID DENSITY (Load-Master)
F:	D06705	kg/m3	WT2S LIQUID DENSITY (Load-Master)
G:	D06706	kg/m3	WT2P LIQUID DENSITY (Load-Master)
H:	D06707	kg/m3	WT3BS LIQUID DENSITY (Load-Master)
I:	D06710	kg/m3	WT3BP LIQUID DENSITY (Load-Master)
J:	D06711	kg/m3	CT3 LIQUID DENSITY (Load-Master)
K:	D06712	kg/m3	WT4S LIQUID DENSITY (Load-Master)
L:	D06713	kg/m3	WT4P LIQUID DENSITY (Load-Master)
M:	D06714	kg/m3	CT4 LIQUID DENSITY (Load-Master)
N:	D06715	kg/m3	WT5S LIQUID DENSITY (Load-Master)
O:	D06716	kg/m3	WT5P LIQUID DENSITY (Load-Master)
P:	D06717	kg/m3	WT6S LIQUID DENSITY (Load-Master)
Q:	D06720	kg/m3	WT6P LIQUID DENSITY (Load-Master)
R:			
S:			
T:			

2.171 Page:0703 M** LOAD-MASTER : TEMPERATURES (inputs)

A:	T06760	degC	FPT BALLAST TEMPERATURE (Load-Master)
B:	T06761	degC	CT1 CARGO TEMPERATURE (Load-Master)
C:	T06762	degC	WT1S CARGO TEMPERATURE (Load-Master)
D:	T06763	degC	WT1P CARGO TEMPERATURE (Load-Master)
E:	T06764	degC	CT2 CARGO TEMPERATURE (Load-Master)
F:	T06765	degC	WT2S CARGO TEMPERATURE (Load-Master)
G:	T06766	degC	WT2P CARGO TEMPERATURE (Load-Master)
H:	T06767	degC	WT3BS BALLAST TEMPERATURE (Load-Master)
I:	T06770	degC	WT3BP BALLAST TEMPERATURE (Load-Master)
J:	T06771	degC	CT3 CARGO TEMPERATURE (Load-Master)
K:	T06772	degC	WT4S CARGO TEMPERATURE (Load-Master)
L:	T06773	degC	WT4P CARGO TEMPERATURE (Load-Master)
M:	T06774	degC	CT4 CARGO TEMPERATURE (Load-Master)
N:	T06775	degC	WT5S CARGO TEMPERATURE (Load-Master)
O:	T06776	degC	WT5P CARGO TEMPERATURE (Load-Master)
P:	T06777	degC	WT6S SLOP TEMPERATURE (Load-Master)
Q:	T06780	degC	WT6P SLOP TEMPERATURE (Load-Master)
R:			
S:			
T:			

2.172 Page:0704 M** LOAD-MASTER : SOUNDINGS

A:	L06500	m	FPT SOUNDING (Load-Master)
B:	L06501	m	CT1 SOUNDING (Load-Master)
C:	L06502	m	WT1S SOUNDING (Load-Master)
D:	L06503	m	WT1P SOUNDING (Load-Master)
E:	L06504	m	CT2 SOUNDING (Load-Master)
F:	L06505	m	WT2S SOUNDING (Load-Master)
G:	L06506	m	WT2P SOUNDING (Load-Master)
H:	L06507	m	WT3BS SOUNDING (Load-Master)
I:	L06510	m	WT3BP SOUNDING (Load-Master)
J:	L06511	m	CT3 SOUNDING (Load-Master)
K:	L06512	m	WT4S SOUNDING (Load-Master)
L:	L06513	m	WT4P SOUNDING (Load-Master)
M:	L06514	m	CT4 SOUNDING (Load-Master)
N:	L06515	m	WT5S SOUNDING (Load-Master)
O:	L06516	m	WT5P SOUNDING (Load-Master)
P:	L06517	m	WT6S SOUNDING (Load-Master)
Q:	L06520	m	WT6P SOUNDING (Load-Master)
R:	L06521	m	FHFO SOUNDING (Load-Master)
S:	L06522	m	AHFO SOUNDING (Load-Master)
T:			

2.173 Page:0705 M** LOAD-MASTER : ULLAGES

A:	U06530	m	L=0.0	H=0.0	FPT TANK ULLAGE (Load-Master)
B:	U06531	m	L=0.0	H=0.0	CT1 TANK ULLAGE (Load-Master)
C:	U06532	m	L=0.0	H=0.0	WT1S TANK ULLAGE (Load-Master)
D:	U06533	m	L=0.0	H=0.0	WT1P TANK ULLAGE (Load-Master)
E:	U06534	m	L=0.0	H=0.0	CT2 TANK ULLAGE (Load-Master)
F:	U06535	m	L=0.0	H=0.0	WT2S TANK ULLAGE (Load-Master)
G:	U06536	m	L=0.0	H=0.0	WT2P TANK ULLAGE (Load-Master)
H:	U06537	m	L=0.0	H=0.0	WT3BS TANK ULLAGE (Load-Master)
I:	U06540	m	L=0.0	H=0.0	WT3BP TANK ULLAGE (Load-Master)
J:	U06541	m	L=0.0	H=0.0	CT3 TANK ULLAGE (Load-Master)
K:	U06542	m	L=0.0	H=0.0	WT4S TANK ULLAGE (Load-Master)
L:	U06543	m	L=0.0	H=0.0	WT4P TANK ULLAGE (Load-Master)
M:	U06544	m	L=0.0	H=0.0	CT4 TANK ULLAGE (Load-Master)
N:	U06545	m	L=0.0	H=0.0	WT5S TANK ULLAGE (Load-Master)
O:	U06546	m	L=0.0	H=0.0	WT5P TANK ULLAGE (Load-Master)
P:	U06547	m	L=0.0	H=0.0	WT6S TANK ULLAGE (Load-Master)
Q:	U06550	m	L=0.0	H=0.0	WT6P TANK ULLAGE (Load-Master)
R:	U06551	m	L=0.0	H=0.0	FHFO TANK ULLAGE (Load-Master)
S:	U06552	m	L=0.0	H=0.0	AHFO TANK ULLAGE (Load-Master)
T:					

2.174 Page:0706 M** LOAD-MASTER : MASSES

A:	M06560	tonn	FPT TANK MASS (Load-Master)
B:	M06561	tonn	CT1 TANK MASS (Load-Master)
C:	M06562	tonn	WT1S TANK MASS (Load-Master)
D:	M06563	tonn	WT1P TANK MASS (Load-Master)
E:	M06564	tonn	CT2 TANK MASS (Load-Master)
F:	M06565	tonn	WT2S TANK MASS (Load-Master)
G:	M06566	tonn	WT2P TANK MASS (Load-Master)
H:	M06567	tonn	WT3BS TANK MASS (Load-Master)
I:	M06570	tonn	WT3BP TANK MASS (Load-Master)
J:	M06571	tonn	CT3 TANK MASS (Load-Master)
K:	M06572	tonn	WT4S TANK MASS (Load-Master)
L:	M06573	tonn	WT4P TANK MASS (Load-Master)
M:	M06574	tonn	CT4 TANK MASS (Load-Master)
N:	M06575	tonn	WT5S TANK MASS (Load-Master)
O:	M06576	tonn	WT5P TANK MASS (Load-Master)
P:	M06577	tonn	WT6S TANK MASS (Load-Master)
Q:	M06600	tonn	WT6P TANK MASS (Load-Master)
R:	M06601	tonn	FHFO TANK MASS (Load-Master)
S:	M06602	tonn	AHFO TANK MASS (Load-Master)
T:			

2.175 Page:0707 M** LOAD-MASTER : MISC TANKS

A:	V06751	%	FHFO TANK VOLUME (Load-Master)
B:	V06752	%	AHFO TANK VOLUME (Load-Master)
C:	V06755	%	HFO SETTLING TANK VOLUME (Load-Master)
D:	V06756	%	HFO SERVICE TANK VOLUME (Load-Master)
E:	V06757	%	DO STORAGE TANK VOLUME (Load-Master)
F:	V06758	%	DO SETTLING TANK VOLUME (Load-Master)
G:	V06759	%	DO SERVICE TANK VOLUME (Load-Master)
H:	V06753	%	FW/LO VOLUME (Load-Master)
I:			
J:			
K:	M06601	tonn	FHFO TANK MASS (Load-Master)
L:	M06602	tonn	AHFO TANK MASS (Load-Master)
M:	M06605	tonn	HFO SETTLING TANK MASS (Load-Master)
N:	M06606	tonn	HFO SERVICE TANK MASS (Load-Master)
O:	M06607	tonn	DO STORAGE TANK MASS (Load-Master)
P:	M06608	tonn	DO SETTLING TANK MASS (Load-Master)
Q:	M06609	tonn	DO SERVICE TANK MASS (Load-Master)
R:	M06603	tonn	FW/LO MASS (Load-Master)
S:			
T:			

2.176 Page:0708 M** LOAD-MASTER : DRAFT ++

A:			
B:			
C:	L04020	m	MEAN DRAFT (Load-Master)
D:	L04021	m	HULL TRIM (Load-Master)
E:	L04022	m	HULL HEEL (Load-Master)
F:			
G:			
H:	Z04031	%	DEADWEIGHT (relative)(Load-Master)
I:	M04030	ktonn	DEADWEIGHT (Load-Master)
J:			
K:	M04032	ktonn	DISPLACEMENT (Load-Master)
L:			
M:			
N:			
O:			
P:			
Q:			
R:			
S:			
T:			

2.177 Page:0710 M** LOAD-MASTER : HULL SHEAR FORCES

A:					
B:	P06400	ktonn	L=-20.0	H=20.0	SHEAR FORCE (section 0) (LM)
C:	P06401	ktonn	L=-16.0	H=16.0	SHEAR FORCE (section 1) (LM)
D:	P06402	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 2) (LM)
E:	P06403	ktonn	L=-20.0	H=20.0	SHEAR FORCE (section 3) (LM)
F:	P06404	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 4) (LM)
G:	P06405	ktonn	L=-16.0	H=16.0	SHEAR FORCE (section 5) (LM)
H:	P06406	ktonn	L=-16.0	H=16.0	SHEAR FORCE (section 6) (LM)
I:	P06407	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 7) (LM)
J:	P06410	ktonn	L=-22.0	H=22.0	SHEAR FORCE (section 8) (LM)
K:	P06411	ktonn	L=-18.0	H=18.0	SHEAR FORCE (section 9) (LM)
L:	P06412	ktonn	L=-14.0	H=14.0	SHEAR FORCE (section 10) (LM)
M:	P06413	ktonn	L=-12.0	H=12.0	SHEAR FORCE (section 11) (LM)
N:	P06414	ktonn	L=-20.0	H=20.0	SHEAR FORCE (section 12) (LM)
O:					
P:					
Q:					
R:					
S:					
T:					

2.178 Page:0711 M** LOAD-MASTER : HULL BENDING MOMENTS

A:					
B:	Q06420	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 0) (LM)
C:	Q06421	ktonm	L=-300.0	H=300.0	BENDING MOMENT (section 1) (LM)
D:	Q06422	ktonm	L=-350.0	H=350.0	BENDING MOMENT (section 2) (LM)
E:	Q06423	ktonm	L=-500.0	H=500.0	BENDING MOMENT (section 3) (LM)
F:	Q06424	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 4) (LM)
G:	Q06425	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 5) (LM)
H:	Q06426	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 6) (LM)
I:	Q06427	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 7) (LM)
J:	Q06430	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 8) (LM)
K:	Q06431	ktonm	L=-500.0	H=500.0	BENDING MOMENT (section 9) (LM)
L:	Q06432	ktonm	L=-200.0	H=200.0	BENDING MOMENT (section 10) (LM)
M:	Q06433	ktonm	L=-200.0	H=200.0	BENDING MOMENT (section 11) (LM)
N:	Q06434	ktonm	L=-700.0	H=700.0	BENDING MOMENT (section 12) (LM)
O:					
P:					
Q:					
R:					
S:					
T:					

2.179 Page:0712 M** LOAD-MASTER : HULL DEFLECTIONS

A:			
B:	L06440	m	HULL DEFLECTION (section 0) (LM)
C:	L06441	m	HULL DEFLECTION (section 1) (LM)
D:	L06442	m	HULL DEFLECTION (section 2) (LM)
E:	L06443	m	HULL DEFLECTION (section 3) (LM)
F:	L06444	m	HULL DEFLECTION (section 4) (LM)
G:	L06445	m	HULL DEFLECTION (section 5) (LM)
H:	L06446	m	HULL DEFLECTION (section 6) (LM)
I:	L06447	m	HULL DEFLECTION (section 7) (LM)
J:	L06450	m	HULL DEFLECTION (section 8) (LM)
K:	L06451	m	HULL DEFLECTION (section 9) (LM)
L:	L06452	m	HULL DEFLECTION (section 10) (LM)
M:	L06453	m	HULL DEFLECTION (section 11) (LM)
N:	L06454	m	HULL DEFLECTION (section 12) (LM)
O:			
P:			
Q:			
R:			
S:			
T:			

2.180 Page:0713 M** LOAD-MASTER : HULL STABILITY

A:			
B:	L06460	m	RIGHTING LEVER (GZ) (0 dgr) (LM)
C:	L06461	m	RIGHTING LEVER (GZ) (5 dgr) (LM)
D:	L06462	m	RIGHTING LEVER (GZ) (10 dgr) (LM)
E:	L06463	m	RIGHTING LEVER (GZ) (15 dgr) (LM)
F:	L06464	m	RIGHTING LEVER (GZ) (20 dgr) (LM)
G:	L06465	m	RIGHTING LEVER (GZ) (25 dgr) (LM)
H:	L06466	m	RIGHTING LEVER (GZ) (30 dgr) (LM)
I:	L06467	m	RIGHTING LEVER (GZ) (35 dgr) (LM)
J:	L06470	m	RIGHTING LEVER (GZ) (40 dgr) (LM)
K:	L06471	m	RIGHTING LEVER (GZ) (45 dgr) (LM)
L:	L06472	m	RIGHTING LEVER (GZ) (50 dgr) (LM)
M:	L06473	m	RIGHTING LEVER (GZ) (55 dgr) (LM)
N:	L06474	m	RIGHTING LEVER (GZ) (60 dgr) (LM)
O:			
P:	L06475	m	METACENTRIC HEIGHT (corrected) (LM)
Q:	L06476	m	FREE SURFACE (reduction) (LM)
R:	E06477	mrad	DYNAMIC STABILITY (area 0-40 dgr) (LM)
S:			
T:			

2.181 Page:0800 M** MOTION PLATFORM CONTROL

A:			
B:	X07053	<0-1>	ACTIVATE MOTION PLATFORM (=1)
C:			
D:	S07501	<0-1>	MP->HYDRAULIC OIL LEVEL OK
E:	S07502	<0-1>	MP->HYDRAULIC OIL PRESS OK
F:	S07503	<0-1>	MP->HYDRAULIC OIL TEMP OK
G:	S07504	<0-1>	MP->MAIN DOOR CLOSED
H:	S07505	<0-1>	MP->EMERGENCY DOOR CLOSED
I:	S07506	<0-1>	MP->GANGWAY RETRACTED
J:	S07507	<0-1>	MP->POWER PACK RUNNING
K:			
L:	S07508	<0-1>	MP->EMERGENCY STOP OK
M:			
N:	S07509	<0-1>	MP->PUSH BUTTON READY
O:	S07510	<0-1>	MP->PUSH BUTTON MOTION OFF
P:	S07511	<0-1>	MP->PUSH BUTTON MOTION ON
Q:			
R:	S07512	<0-1>	MP->ROLL SENSOR FAIL
S:	S07513	<0-1>	MP->PITCH SENSOR FAIL
T:			

2.182 Page:0900 M** SIM CONTROL - INPUT ACCESS

A:			
B:			
C:	X07110	<0-1>	SET LOADED SHIP (preset condition)
D:	X07111	<0-1>	SET UNLOADED SHIP (preset condition)
E:			
F:			
G:	Z03513	<0-1>	BOILER ISOLATION
H:	V03563	<0-1>	IG ISOLATION
I:			
J:			
K:			
L:			
M:			
N:			
O:			
P:	X07053	<0-1>	ACTIVATE MOTION PLATFORM (=1)
Q:			
R:			
S:			
T:			

2.183 Page:0901 M** SIM CONTROL - TRIP STATE SURVEY

A:					
B:	X07020	<0-1>			EMERGENCY RUN (trip inhibit)
C:					
D:					
E:	X02247	<0-5>	L=0.0	H=1.0	COP1 TRIP INDICATION
F:	X02447	<0-5>	L=0.0	H=1.0	COP2 TRIP INDICATION
G:	X02647	<0-5>	L=0.0	H=1.0	COP3 TRIP INDICATION
H:	X03047	<0-5>	L=0.0	H=1.0	COP4 TRIP INDICATION
I:	X03247	<0-5>	L=0.0	H=1.0	BWP TRIP INDICATION
J:					
K:					
L:					
M:					
N:					
O:					
P:					
Q:					
R:					
S:					
T:					

2.184 Page:0902 M** SIM CONTROL - ALARM SYSTEM

A:			
B:	X07020	<0-1>	EMERGENCY RUN (trip inhibit)
C:			
D:			
E:	X07200	<0-1>	ALARM SYSTEM ACTIVE
F:			
G:	X07201	<0-1>	ALARM OK : TANK ULLAGE
H:	X07202	<0-1>	ALARM OK : TANK INERT GAS
I:	X07203	<0-1>	ALARM OK : TANK TEMPERATURE
J:	X07204	<0-1>	ALARM OK : HULL SHEAR / BENDING
K:	X07205	<0-1>	ALARM OK : INERT GAS GENERATOR
L:	X07206	<0-1>	ALARM OK : OIL DISCHARGE MONITOR
M:	X07207	<0-1>	ALARM OK : LOAD MASTER
N:			
O:	X07211	<0-1>	ALARM OK : CARGO PUMP 1
P:	X07212	<0-1>	ALARM OK : CARGO PUMP 2
Q:	X07213	<0-1>	ALARM OK : CARGO PUMP 3
R:	X07214	<0-1>	ALARM OK : CARGO PUMP 4
S:	X07215	<0-1>	ALARM OK : BALLAST PUMP
T:			