TAI CHONG CHEANG STEAMSHIP CO (SINGAPORE) PTE LTD

VOC MANAGEMENT PLAN

For compliance with Regulation 15.6,
Annex VI of MARPOL 73/78

M.T. KHK VISION

IMO No. 9323429
Flag: Singapore
Call Sign: 9VDZ4

MANUAL REVISIONS

The following Revisions have been made to the Manual which is indicated by the Revision Number and Date as shown on each page in the Header.

Revision Number	Revision Date	Pages Affected
Initial Version – 000 Revised	15-Oct-2020	VOC Management Plan issued

CONTENTS

11. Record Keeping

12. Designated Person

12.1 Qualification of Designated Person
12.2 Designated Person of the Vessel

13. Appendix

13.1 General Arrangement
13.2 Piping Diagram of Cargo System
13.3 Piping Diagram of Ballast System
13.4 Piping Diagram of Cargo Tank Vent/Inert Gas System
13.5 Piping Diagram of Crude Oil Washing
13.6 Specification for the COW machine and washing system
13.7 Piping Diagram of Vapour Emission/High High level alarm System
13.8 Detail of Electric earth bonding installation
13.9 Detail of Vapour connection – Manufacture Drawing
13.10 Marpol Annex VI, Regulation 15 – Volatile organic compounds
13.11 Annex 10 of IMO Resolution MEPC 185(59)

14. Reference

14.1 Crude Oil Washing System Manual [Drawing No. DA800D113]
14.2 Operation and Equipment Manual for Vapour Emission Control System [Drawing No.DA800D111]
14.3 Flue Inert Gas System Manual [OSP No. IG110101B6C8-OHJW0S]

INTRODUCTION

1. Regulation 15 of Annex VI of MARPOL 73/78, as revised by IMO Resolution MEPC.176 (58) (hereinafter referred to as "revised Annex VI") regulate the VOC emissions from a tanker in designated port(s) or terminal(s) of a Party regulating such emissions. Regulation 15.6 requires that a tanker carrying crude oil shall have on board and implement a VOC Management Plan (VOC Plan) approved by the Administration in accordance with IMO resolution MEPC.185 (59). This Plan shall be specific to each ship.

2. The aim of the VOC Plan is to identify the arrangements and equipment required to enable compliance with regulation 15.6 of the revised Annex VI and to identify for the ship's officers all operational procedures for VOC emission control.

3. This VOC Plan has been written pursuant to the requirements in the revised Annex VI regulation 15.6, and it has been developed in accordance with the Resolution MEPC. 185(59) "Guidelines for the Development of a VOC Management Plan"**,** having taken into account the provisions of MEPC.1/Circ.680 "Technical Information on systems and operation to assist development of VOC Management Plans".

4. The VOC Plan describes the specific arrangement, operations and conditions onboard a crude oil tanker with respect to the emission and ability to control VOC emissions. This VOC Plan is not a safety guide and reference shall be made to other publications to evaluate safety hazards.

5. This VOC Plan has been approved by ABS on behalf of the Administration and no alteration or revision shall be made to any part of it without their prior approval.

1.1 The purpose of the VOC management plan is to ensure that the operation of a tanker, to which regulation 15 of MARPOL Annex VI applies, prevents or minimizes VOC emissions to the extent possible.

1.2 Emissions of VOC can be prevented or minimized by:

a) Optimizing operational procedures to minimize the release of VOC emissions; and/or

b) Using devices, equipment, or design changes to prevent or minimize VOC emissions.

1.3 To comply with this plan, the loading and carriage of cargoes which generate VOC emissions should be evaluated and procedures written to ensure that the operations of a ship follow best management practices for preventing or minimizing VOC emissions to the extent possible. If devices, equipment, or design changes are implemented to prevent or minimize VOC emissions, they shall also be incorporated and described in the VOC management plan as appropriate.

1.4 While maintaining the safety of the ship, the VOC management plan should encourage and, as appropriate, set forth the following best management practices:

a) The loading procedures should take into account potential gas releases due to low pressure and, where possible, the routing of oil from crude oil manifolds into the tanks should be done so as to avoid or minimize excessive throttling and high flow velocity in pipes;

b) The ship should define a target operating pressure for the cargo tanks. This pressure should be as high as safely possible and the ship should aim to maintain tanks at this level during the loading and carriage of relevant cargo. The target operating pressure is also determined by communication between the designated onboard person and the shore side person in-charge prior to starting the cargo loading;

c) When venting to reduce tank pressure is required, the decrease in the pressure in the tanks should be as small as possible to maintain the tank pressure as high as possible;

d) The amount of inert gas added should be minimized. Increasing tank pressure by adding inert gas does not prevent VOC release but it may increase venting and therefore increased VOC emissions. lnert gas supply or topping-up into the cargo tanks at sea is to be as minimum as possible so as not to increase the predetermined or target operating tank pressure and;

e) When crude oil washing, VOC emissions are to be reduced by shortening the duration of the washing as possible as allowed, or by using a closed cycle crude oil washing program.

1.5 The VOC management plan also includes the following contents to ensure the management practice above para.1.4:

a) A person in charge of carrying out the plan (See Chapter 12)
- A person shall be designated in the VOC management plan to be responsible for implementing the plan and that person may assign appropriate personnel to carry out the relevant tasks;

b) Procedures for preventing or minimizing VOC emissions (See Chapter 4):
- Ship-specific procedures should be written or modified to address relevant VOC emissions, such as the following operations:
  I. Loading;
  II. Carriage of relevant cargo; and
  III. Crude oil washing;

c) If the ship is equipped with VOC reduction devices or equipment, the use of these devices or equipment should be incorporated into the above procedures as appropriate.

d) Training (See Chapter 10)
- The plan should describe the training programmes to facilitate best management practices for the ship to prevent or minimize VOC emissions.

2.1 General Description of Ship System

a) Ship in general

This vessel is designed and constructed to carry, loading, and discharging intended cargoes as below for worldwide trading under following Classification symbols.

+A1(E), “Oil Carrier”, SH, SHCM, +AMS, +ACCU, RW, with the descriptive notes of ESP, UWILD.

- Cargo handling system is designed based on the conventional pump room solution and is designed capable of loading or discharging three grades of cargo simultaneously, concurrently with ballasting or deballasting.

- The cargo oil system and its associated system shall be designed to be capable of loading the cargo through three (3) cargo manifold with a design rate of approx. 20,500 M3/H in total, when two (2) cargo oil tanks are engaged in each segregation (i.e., approx. 6,840 M3/H per each segregation and approx. 3,420 M3/H per each cargo oil tank)

- Vapour emission control system on board this ship is designed to fulfil the requirements of USCG including lightering operation under Letter Of Compliance issued by Classification Society.

- Maximum vapour/air density of loadable cargoes on this ship is 3.0 kg/M3.

- Intended cargoes (CARGO LIST - See the following pages on Cargo Information) are as follows. H. 5268: crude oil.

- Smaller size of G/A plan is attached in the Appendix of this manual and ordinary scale of drawing is retained separately on board.

- This vessel is designed and constructed under the intention of no restriction to carry out lightering operation as per demand from USCG.

Cargo Information – Only Reference

Crude Oil

Country	Crude Name	Specific Gravity	Remark
Algeria	Saharan Blend	44.0 (API 60)	
Angola	Cabinda	31.7 (API 60)	
Brunei	Champion Export	23.9 (API 60)	
Colombia	Cano Limon	0.8718	
Egypt	East Zeit	0.829 1	
	Gulf Suez Mix	0.8660	
	Ras Kharib	0.9040	
Ecuador	Oriente	0.8805	
Indonesia	Lalang	0.8251	
	Sumatran Heavy	0.9273	
	Sumatran light	34.5 (API 60)	
Iran	Iranian Heavy	0.8707	
	Iranian Light	0.8560	
Iraq	Basrah Heavy	0.9059	
	Kirkuk Blend	0.8493	
Kuwait	Burgan	0.9141	
	Kuwait Export	0.8686	
Libya	Brega	0.8251	
	High Pour	0.8449	
	Zueitina	0.8189	
Malaysia	Miri Light	0.8423	
Mexico	Isthmus	0.8509	
Nigeria	Bony Light	0.8413	
	Bony Medium	0.9030	
	Escravos	0.8438	
	Brass River	0.8208	
Norway	Ekofisk	0.8090	
	Statfjord	0.8328	
Oman	Oman Export	0.8433	
Saudi Arabia	Arabian Heavy	0.8905	
	Arabian Light	0.8581	
	Arabian Medium	0.8844	
	Arabian Extra Light	0.8388	
	Burgan	0.9141	
	Khafji	0.8844	

Crude Oil

Country	Crude Name	Specific Gravity	Remark
U.K.	Brent	0.8343	
	Cormorant	0.8504	
	Niniom Blend	0.8468	
USA	Alaska North Slope	0.8899	
Venezuela	Boscan	0.9993	
	Ceuta	0.8665	
	Laguna	0.9923	
	Mesa	0.8762	
	Tijnana Light	0.8649	
	Tijnana Pesado	0.9854	

2.2 Ship's Main Particulars
Refer to 13.1 "GENERAL ARRANGEMENT" for the tank arrangement.

Table 2.2 Ship's main Particulars

Ship's Name	KHK Vision
Length (L.B.P)	320.0 M
Breadth (MLD)	58.0 M
Depth (MLD)	31.2 M
Design draft	20.8 M
Scanting draft	22.4 M
Deadweight	306,000 MT (Design)
Cargo Tank Capacity (including SLOP TANK)	352,231.7 M3
Water Ballast Capacity (including Peak tanks)	100,465.7 M3
Fuel Oil Tank Capacity	7,823.3 M3
Diesel Oil Tank Capacity	459.4 M3

2.3 Particulars of Pumps

Table 2.3 Particulars of Pumps

Cargo Oil Pump	Vertical Centrifugal 5,000 m3/h x 150 mTH (-5m) x 3 Sets
Automatic Unloading system	AUS 454-3 x 1 Set (SHINKO LTD.)
Cargo Oil Stripping Pump	Steam driven vertical double stroke 350 m3/h x 150 mTH x 1 set
Water Ballast Pump	Vertical Centrifugal Single stage 3,000 m3/h x 35 mTH x 2 set
Water Ballast Stripping Eductor	Water driven 300 m3/h x 2 set
Cargo Stripping Eductor	Driving from Cargo Pump 850 m3/h x 2 set

2.4 Particulars of Cargo and Ballast Relating Equipments

Table 2.4 Particulars of Cargo and Ballast Relating Equipments

1. Main Cargo Oil Piping	
In tank (Suction)	3 - lines of 750 mm dia.
In tank (Disch)	3 - lines of 650 mm dia.
2. Cargo Oil Stripping Piping	
In tank (Suction)	Not provided for exclusive use, but stripping branches to be branched from the main line.
In tank (Disch)	1 - line of 200 mm dia.
3. Ballast Water Piping	
In tank	2 - line of 600 mm dia.
4. Ballast Stripping Piping	
In tank	Not provided for exclusive use, but stripping branches to be branched from the main line.
5. Cargo Oil Valve Operation	All valves in tanks, main valves in pump room are hydraulically operated from cargo control console and local control box. Other valves are operated by manual at valve side. For detail information, refer to “Plan Drawing of Cargo/Ballast System” in Appendix 13.2 and 13.3.
6. Tank Level Gauge System	All cargo oil tanks are equipped with Radar beam type level transmitter. Water ballast tanks including fore peak tanks and aft peak tank are equipped with electric-Pneumatic sensing type level gauge system (Sounding indication).

3.1 Cargo Tanks

This vessel has 17 cargo tanks and is located in front of Pump Room.

The specification of cargo tanks is shown in Table 3.1.

The setting pressures of each pressure/vacuum valve are defined so as not to be more than the allowable cargo tank ullage pressure as the Table 3.1, i.e. these setting pressures are defined considering to some safety factors, so that the tank structural failure due to over /under pressure does not occur.

Table 3.1 List of Cargo Tanks and Setting Pressure of Cargo Tank Venting System

Tank No.	Capacity (m3) (98 %)	Allowable Ullage Pressure (MPa)	Setting Pressure of PV Valve* (MPa)		Setting Pressure of PV Breaker* (MPa)		Setting Pressure of Pressure Alarm (MPa)	
			Pressure Side (min.)	Vacuum Side (max.)	Pressure Side (min.)	Vacuum Side (max.)	High Pressure (MPa)	Low Pressure (MPa)
No. 1 (P/S)	16,255.0	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
No. 2 (P/S)	20,198.8	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
No. 3 (P/S)	20,198.8	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
No. 4 (P/S)	20,198.8	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
No. 5 (P/S)	14,244.6	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
No. 1 (C)	27,673.1	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
No. 2 (C)	31,886.4	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
No. 3 (C)	31,886.4	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
No. 4 (C)	31,886.4	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
No. 5 (C)	31,886.4	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
Slop (P)	3,832.4	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
Slop (S)	3,832.4	0.014	0.014	0.0035	0.018	0.007	0.015	0.005
(Total)	345,187							

* Names of Pressure / Vacuum relief systems and their setting pressures are to be shown in applicable boxes.

3.2 Cargo Tank Venting System

a) The vessel is provided with the inert gas supply main and this is also used for the control of cargo vapour release (See Chapter 4). This line is fitted with branch piping leading to each cargo tank. Branch piping for inert gas is fitted with either stop valves or equivalent means of control for isolating each tank. The stop valves are provided with locking arrangement, which is under the control of a responsible vessel's officer.

In addition, the vessel has the independent vent post with the high velocity relief/vacuum valve for each cargo tank. This system also enables thermal breathing from cargo tanks when the isolation valve is closed.

A liquid-filled P/V breaker is typically connected to the cargo tank venting/inert gas main. The P/V breaker has a capacity to accommodate the gas flow from cargo tanks during loading (125% of the loading rate and discharge rate).

The cargo tank venting/inert gas main is typically used during loading and discharging operations. During loading the mast riser valve is open (unless vapour emission control is performed) and VOC is expelled to air. During discharge the same valve is closed and inert gas used to replace the tank atmosphere.

The detail of the venting system can be found in "13.4 Piping Diagram of Cargo Tank Vent/Inert Gas System.

b) In addition, the vessel is provided with "Vapour Emission Control. The purpose of the system is to return the vapour containing VOC to shore terminal not to relief the vapour to atmosphere in ports/terminals.

To comply with the VECS requirement of USCG CFR, the vessel is provided with Vapour Return Line and its Manifold, pressure sensors and their alarms, high level alarms and tank overfill alarms, etc…

For the detail of on VECS system and this operation, it can be found in "Operation and Equipment Manual for Vapour Emission Control System [dwg. No.DA800D111]". This manual also shows the maximum allowable loading rate with max. vapour densities.

3.3 Inert Gas System

The vessel is provided with the inert gas system and the inert gas supply main is also used as cargo vent common line. The system is capable of delivering inert gas to the cargo tanks at a rate of at least 125% of the maximum rate of discharge capacity of the vessel expressed as a volume.

The purpose of inert gas system is inerting in the cargo tanks and relevant pipe lines during loading/unloading/voyage to change from explosive atmosphere to non-explosive atmosphere. However, adding inert gas into cargo tanks, it is possible to relief the mixture of inert gas and VOC to atmosphere acting pressure/relief valve and/or PV Breaker.

The detail of inert gas system can be found in “Operation and Equipment Manual for Vapour Emission Control System [dwg. No.DA800D111]” and “Flue Inert Gas System Manual [OSP. No. IG110101B6C8-OHJW0S]”

3.4 Crude Oil Washing System

The vessel is provided with the fixed type of crude oil washing system. The purpose of the system is to wash in the cargo tanks by crude oil using not only cleaning effect of physical spray impact but also crude oil chemical characteristics to dissolve the sludge such as waxes or asphalt in crude oil. However, cargo vapour generates as a result of the Crude Oil Washing of the cargo tanks.

The detail of crude oil washing system can be found in “13.5 Piping Diagram of Crude Oil Washing” as attached, and can make reference to “Crude Oil Washing System Manual [dwg. No. DA800D113] which is placed onboard the vessel”.

3.5 Vapour Emission Control System – Design and Specification

a) When loading of cargoes, oil vapour from cargo tanks to be well managed to avoid over pressure in the tanks. For this purpose, following principle functions are provided and installed.
   - Individual vent through H/V P/V valve on each tank
   - Vent riser connected to I.G.S main (common free flow venting system)
   - Crossover manifold to shore connected to I.GS main which as a part of VECS requirement.

b) As demanded by USCG 46 CFR Part 39, this manual described mainly design and installations related the crossover manifold connected to IGS main as Vapour collecting piping.

c) IG system on this vessel is designed based on discharging capacity of 15,000 M3/H from ship when Cargo Oil Pumps are running on each segregation of cargo discharging piping. This concept result that IGS plant and its associate piping is able to handle 19,000 N M3/H of Inert Gas from the plant. Before the VECS operation, IG001 valve to be closed for the

separation / isolation of IG plant / piping and VECS piping as required by USCG 46 CFR Part 39.20 -1(a)(6).

d) VECS collecting piping is commonly used with I.G supply piping when loading and connected to cross over shore manifold by which oil vapour in cargo tanks during loading can be transferred to shore.

- Diameter of vapour main to shore: ND 600
- Diameter of vapour branch from each tank to main: ND 300
- Material of vapour piping:
  Main: steel 2.7t,
  Branch: steel sch. 80
- Vapour piping is electrically bonded to the hull by using toothed washer on the flange joint and anchor point to the hull.
- Drain/condensate from the vapour main piping is returned to slop tank naturally/ gravitationally via inert gas branch pipes.

e) Vapour connection

- Vessel vapour connection is located fore and abaft of midship cargo manifold PORT and STBD in accordance with OCIMF.
- Refer Chapter 13 - Appendix of this manual for location of vessel vapour connection.
- Vessel vapour connection is labelled and coloured as required by USCG 46 CFR Part 39.20-l (d) i.e. red / yellow / red colour with "VAPOUR" in black letter.

f) Flange and fitting

- At the vessel vapour connection, 16"(400A) ANSI B16.5 Classl50 Flange are provided.
- Two reducers, at same specification of 12" (300A) connections are stored on board.
- 0.5-inch diameter and 1 inch length of stud as fitted on the face of flange and reducer.
- Vapour connection in the cargo manifold area is installed according to OCIMF "Recommendation for Oil Tanker Manifold and Associated Equipment”

g) Hoses

Builder does not provide Hoses transferring vapours from vessel vapour connection to shore. However, the owner or operator of the vessel may provide / carry flexible hoses suitable to use as demanded by USCG 46 CFR Part 39.20-l (f).

h) Tank Gauging System

- Each cargo tanks and slop tanks are fitted with closed gauging designed and supplied by SAAB.
- Intrinsically safe type high level alarms are set at corresponding level to 95% volume of the tank (HIGH LEVEL ALARM).
- In addition, portable gauging is also provided in connection with demands from hand dipping on the field of crude oil washing. Each tank is provided 2". Deck seal value for portable gauging that can detect ullage, interface and temperature.
- Refer Chapter 13 – Appendix of this manual and maker's drawing / manual separately retained on board, for further detailed technical information.
- Tank level gauging is displayed on the centralized console in cargo control room and local on the deck.
- Legend as required by USCG 46 CFR Part 39.20-7(c)(2) is provided on cargo control console.

i) Independent overfill alarm

- Independent overfill alarm designed and supplied by SAAB is also provided and installed in each tank set at 98% level of each tank.
- Overfill alarm present audible and visible signal to cargo control room and deck area. Electric flashing light and horn is provided on the flood light post on deck.
- Refer Chapter 13 – Appendix of this manual and maker's drawing / manual separately retained on board, for further detailed technical information.
- Legend as required by USCG 46 CFR Part 39.20-7(d) (3) is provided on cargo control console.
- Power failure alarm as required by USCG 46 CFR Part39.20-7(b) is provided on cargo control console.

j) Vapour pressure / oxygen alarm

- Vapour pressure monitoring system designed and supplied by HANLA LEVEL CO. LTD. and oxygen alarm system supplied by owner for the provisions as required for lightering operation.
- Pressure and oxygen detection is taken from the source on vapour piping near the midship area and alarm indication is displayed in the Cargo Control Room.
- High-Pressure alarm is set at +1200mmwg.
- Low-pressure alarm is set at +100mmwg.
- Refer Chapter 13 – Appendix of this manual and maker's drawing / manual separately retained on board, for further detailed technical information.

k) Pressure vacuum valve

- High velocity P/V valve is fitted on each cargo tanks and slop tanks.
- Diameter of P/V is ND 250 fitted to ND 250 standpipe.
- Design intention of high velocity P/V valve on each tanks are:
  I. To cover breathing effect during cargo voyage due to thermal variation.
  II. Vapour escaping, when loading, where this kind of venting is allowed. For this purpose accumulating of vapour gas as demanded USCG was considered from design.
- Setting of high velocity P/V valve is:
  I. 0.14 kg/cm^2 at pressure side.
  II. 0.035 kg/cm^2 at vacuum side.
- Based on the cargo piping design which is 20,500 M^3/H from shore when 2 tanks are en gaged in every segregation of cargo piping, result of the design base of P/V valve capac ity based on 3,420 M^3/H. Loading of liquid cargo into any cargo tank is 6,341 M^3/H of ga s vapour evacuation from a tank, according to recent USCG demand. P/V valve on this vessel meet this recent USCG requirement.

l) Alarm List

ALARM	SIGNAL	ALARM AT	LOCATION
HIGH LEVEL ALARM	VISIBLE / AUDIBLE	95% each tank	CCR
OVERFILL ALARM	VISIBLE / AUDIBLE	98% each tank	Deck/CCR
VAPOUR MAIN LINE PRESSURE PROTECTION	VISIBLE / AUDIBLE	P (1200mmWG) V (100mmWG)	CCR

CCR: Cargo Control Room

m) Lightering operation
Oxygen analyzer and alarm is provided to meet USCG demand for lightering operation. Electrical insulating of flange is to be achieved when vapour hoses are fitted by means of current continuing strip wire. Detonation arrester is not fitted within 3M of the vessel vapour connection with alarm indication in Cargo Control Room. See operational requirement for lightering operation.

n) Setting of P/V breaker on I.G. main

- Capacity: 19,000 M^3/H
- Opening pressure: 1800mmWG
- Opening vacuum: 700mmWG

o) P/V valve pressure relieving capacity

$Q_a = Q_1$ X VGR X Root ($P_{v\text{-}a,115} \div P_{a,115}$)

where;

Q_a	Required air equivalent volumetric flow rate (M3/H)
Q_1	Loading Rate to each tank *(*3,420 M3/H as design base of building specification)
VGR	Growth rate of crude oil vapour - air mixture 1 + 0.25 X ($P_{v,115} \div 12.5$*)* = 1.003 (1.25 taken as VGR)
$P_{v,115}$	Saturated vapour pressure for crude oil at 115 °F = 0.15
$Þ_{v\text{-}a,115}$	Crude oil vapour - Air weight density at 115 °F
$Þ_{a,115}$	Air weight density at 115°F
$S.G_v$	Specific gravity of crude oil vapour (3.4)
$V_{v,115}$	Partial volume of crude oil vapours at 115°F (specified by the USCG to be taken as 50%)
$V_{a,115}$	Partial volume of air at 115°F (specified by the USCG to be taken as 50%)
$P_{v\text{-}a,115} \div P_{a,115}$	(SG_v) X $(V_{v,115})$ + $V_{a,115}$ = 3.4 X 0.5 + 0.5 = 2.2
Q_a	3,420 X 1.25 X Root 2.2 = 6,341 M3/H

p) P/V valve vacuum relieving capacity
Based on USCG requirement for the vacuum relieving capacity; no growth rate on the vapour density correction is necessary. Accordingly the P/V valve vacuum relieving capacity prevents a vacuum caused during maximum liquid discharge that exceeds the maximum design for any tank connected the vapour collection system.

Notes:
1) Vacuum side of P/V valve on this ship is designed to cover thermal breathing during cargo voyage.
2) During cargo Discharge operation, running of Inert Gas System is essentially required.

3.6 Vapour Emission Control System - Related Equipment

a) Inert Gas system (KANGRIM)

- IGS system on this vessel is designed based on discharging capacity of 15,000 M3/H from pumps. This concept result that IGS plant and its associate piping is able to handle 19,000 N M3/h of Inert Gas from plant.

- VECS collecting piping is commonly used with IG supply piping when loading and connected to cross over shore manifold by which oil vapour in cargo tanks during loading can be transferred to shore.

- Before the VECS operation, IG001 valve to be closed for the separation / isolation of IG plant / piping and VECS piping as required by USCG 46 CFR Part 39.20-1(a)(6).

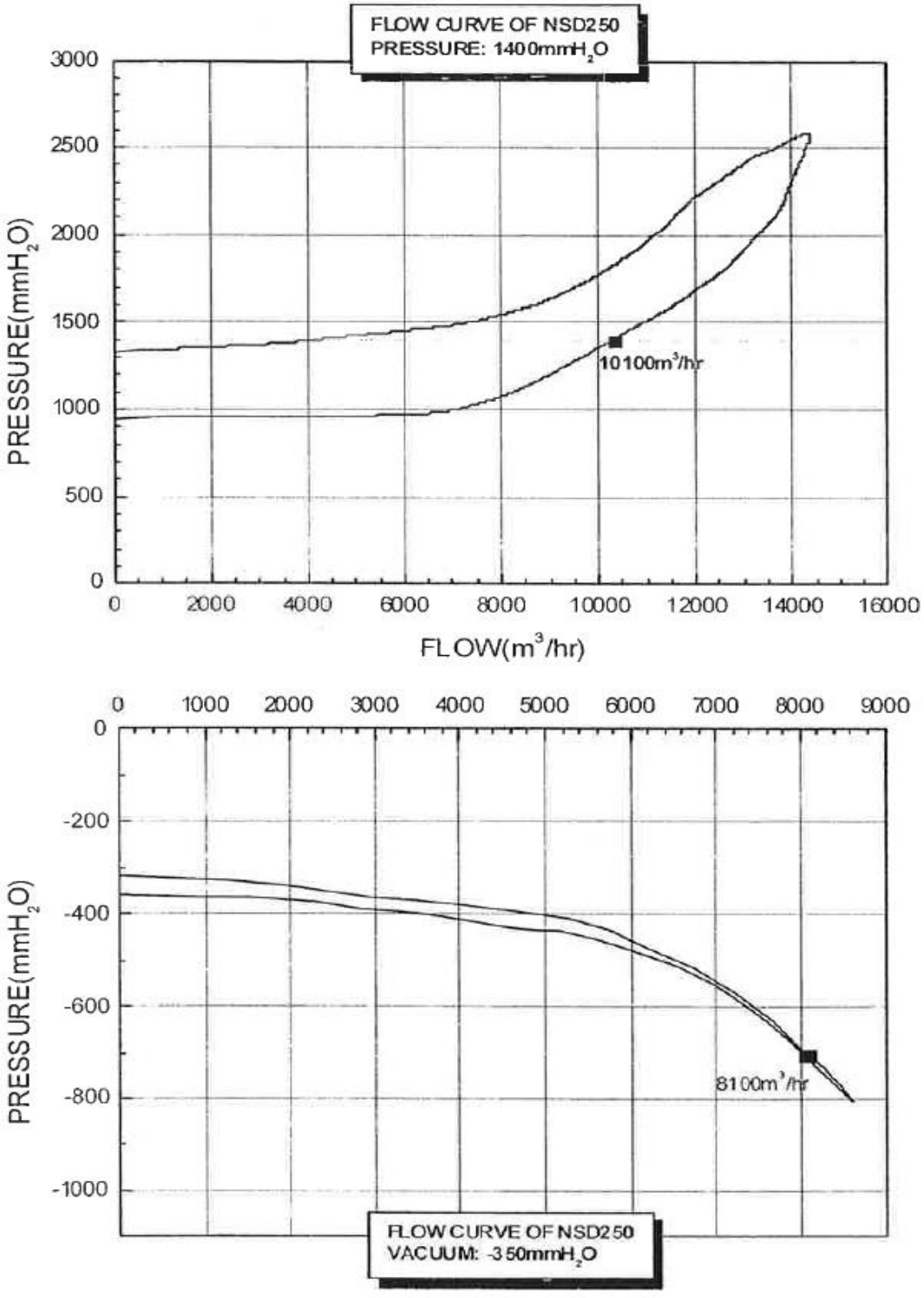
--- This sentence have been described on the IGS manual retained on board separately, as required by USCG 46 CFR Part 32.53-85(b). ---

- Full set of manual and drawing (DV376D101) is retained on board separately as AS BULIT DRAWING of which key – excerpted –copies relating VECS design and operation is enclosed in this manual for quick & easier reference.

b) H/V Pressure / Vacuum Valve (SEWON)

- High velocity P/V valve is fitted on each cargo tanks and slop tanks.
- Diameter of P/V valve is ND 250 fitted to ND 250 standpipe.
- Design intention of high velocity P/V valve on each tanks are:
  I. To cover breathing effect during cargo voyage due to thermal variation.
  II. Vapour escaping, when loading, where this kind of venting is allowed. For this purpose, accumulation of vapour gas as demand USCG was considered in the design.
- Setting of high velocity P/V valves are:
  I. 0.14 kg/cm^2 at pressure side
  II. -0.035 kg/cm^2 at vacuum side
- Full set of manual and drawing (DV374D101) is retained on board separately as AS BUILT DRAWING of which key – excerpted – copies relating VECS design and operation is enclosed in this manual for quick & easier reference.

NSD Type High Velocity Pressure/Vacuum Valve



c) Cargo Tank Level Gauging (SAAB)

- Each cargo tanks and slop tanks are fitted with radar beam principle closed gauging designed and supplied by SAAB products.
- Intrinsically safe type high level alarms are set at corresponding level to 95% volume of the tank (HIGH LEVEL ALARM).
- In addition, portable gauging is also provided in connection with demands from Hand dipping on the field of crude oil washing. Each tank is provided 2" Deck seal value for portable gauging that can detect ullage, interface and temperature.
- Refer APPENDIX of this manual and marker's drawing / manual separately retained on board, for further detailed technical information.
- Tank level gauging is displayed on the centralized console in cargo control room and local on the deck.
- Full set of manual and drawing (DV381D101) is retained on board separately as AS BUILT DRAWING of which key – excerpted – copies relating VECS design and operation is enclosed in this manual for quick & easier reference.
- Legend as required by USCG 46 CFR Part 39.20-7(c)(2) is provided on cargo control console.

d) Vapour pressure monitoring system (HANLA LEVEL) & oxygen alarm system

- Vapour pressure monitoring system designed and supplied by HANLA LEVEL and oxygen alarm system supplied by owner to meet demand for lightering operation.
- Pressure and oxygen detection is taken from the source on vapour piping near the mid-ship area and alarm indication is displayed in the Cargo Control Room.
- Full set of manual and drawing (DV382D101) is retained on board separately as AS BUILT DRAWING of which key – excerpted – copies relating VECS design and operation is enclosed in this manual for quick & easier reference.
- Refer APPENDIX of this manual and marker's drawing / manual separately retained on board, for further detailed technical information.
- Oxygen analyzer and alarm is provided to meet USCG demand for lightering operation. Electrical insulating of flange to be achieved when vapour hoses are fitted by means of current continuing strip wire. Detonation arrester is not fitted onboard since this ship is provided with Inert Gas System. Oxygen sampling connection is fitted within 3M of the vessel vapour connection with alarm indication in Cargo Control Room.

e) Independent high level alarm (SAAB)

- Independent overfill alarm designed and supplied by SAAB is also provided and installed in each tank set at 98% level of each tank.

- Overfill alarm present audible and visible signal to cargo control room and deck area. Flashing light and horn are provided on the flood light post on deck.

- Refer to Chapter 13 – Appendix of this manual and maker's drawing / manual separately retained on board, for further detailed technical information.

- Full set of manual and drawing (DV381D106) is retained on board separately as AS BUILT DRAWING of which key – excerpted – copies relating VECS design and operation is enclosed in this manual for quick & easier reference.

- Legend as required by USCG 46 CFR Part 39.20-7(d)(3) is provided on cargo control console.

- Power failure alarm as required by USCG 46 CFR Part 39.20-7(b) is provided on cargo control console.

f) Lightering Operation – Operation Requirement *(Only For Information)*

- During a lightering or topping off operation each cargo tank being loaded must be connected by the vapour collection system to a cargo tank, which is being discharged.

- If the cargo tanks on both the vessel discharging cargo and the vessel receiving cargo are inerted, the following requirements must be met:

  I. Each tank on a vessel receiving cargo, which is connected to the vapour collection system, must be tested prior to cargo transfer to ensure that the oxygen content in the vapour space does not exceed 8 percent by volume. The oxygen content of each tank must be measured at a point one meter (3.28 feet) below the tank top and at a point equal to one-half of the ullage. Where tanks have partial bulkheads, the oxygen content of each area of that tank formed by each partial bulkhead must be measured at a point one meter (3.28 feet) below the tank top and at a point equal to one-half of the ullage;

  II. The oxygen analyzer, required by §39.40-3(a) must be tested for proper operation prior to the start of each transfer operation;

  III. The oxygen content of vapours being transferred must be continuously monitored during the transfer operation;

  IV. Cargo transfer must be terminated if the oxygen content exceeds 8 percent by volume and must not be restarted until the oxygen content in the tanks of the vessel receiving cargo is reduced to 8 percent by volume or less; and

  V. The vapour transfer hose must be purged of air and inerted prior to starting vapour transfer.

- The isolation valve required by §39.20-1(c) of this part, located on the service vessel must not be opened until the pressure in the vapour collection system on the vessel

receiving cargo exceeds the pressure in the vapour collection system on the vessel discharging cargo.

- The cargo transfer rate must be controlled from the vessel discharging cargo, and must not exceed the maximum, allowable transfer rate for the vessel receiving cargo.

- The pressure in the vapour space of any cargo tank connected to the vapour collection line on either the vessel receiving cargo or the vessel discharging cargo must not exceed 80 percent of the lowest setting of any pressure relief valve during ballasting or cargo transfer.

- All impressed current cathodic protection systems must be de-energized during cargo transfer operations.

Tank washing is prohibited unless the cargo tanks on both the vessel discharging cargo and the vessel receiving cargo are inerted or the tank is isolated from the vapour collection line.

4.1 General Characters of VOC

VOC is a pollutant to the air and act as a precursor to the formation of Troposphere Ozone - commonly termed Smog.

There are four criteria that impact on the extent and rate of evolution of gaseous VOC from crude oils and its subsequent release to atmosphere. These are:

a) The volatility or vapour pressure of the crude oil;
b) The temperature of the liquid and gas phases of the crude oil tank;
c) The pressure setting or control of the vapour phase within the cargo tank; and
d) The size or volume of the vapour phase within the cargo tank

4.2 USCG CFC Regulation of Transfer procedures and Vapour Emission Control

a) Oil Transfer Procedure (USCG 33 CFR 155.750(d))

Regulation text of oil transfer procedure is as follows:

1) If a vessel is fitted with a vapour control system, the transfer procedure must contain a description of the vapour collection system on the vessel which includes:

i) A line diagram of the vessels vapour control system piping, include the location of each valve, control device, pressure vacuum relief valve, pressure indicator flame arresters and detonation arresters, if fitted.
ii) The location of spill valves and runtime disks if fitted.
iii) The maximum allowable transfer rate determined in accordance with 46 CFR Part 39.30. 1(d)(1) through (d)(3).

b) Operational Requirement (46 CFR Part 39.30)

1) Vapour from a tank vessel may not be transferred to:

i) A facility in the United States which does not have its letter of adequacy endorsed as meeting the requirements of 33 CFR part 154, subpart E: or
ii) In the case of a lightering or topping off operation, a vessel that does not have its certificate of inspection or certificate of compliance endorsed as meeting the requirements of this part.

2) The pressure drop through the vapour collection system from the most remote cargo tank to the vessel vapour connection must be:

   i) Determined for each cargo handled by the vapour collection system at the maximum transfer rate and at lesser transfer rates;
   ii) Based on a 50 percent cargo vapour and air mixture, and a vapour growth rate appropriate for the cargo being loaded; and
   iii) Included in the vessel's oil transfer procedures as a table or graph showing the liquid transfer rate versus the pressure drop.

3) If a vessel carries vapour hoses, the pressure drop through the hoses must be included in the pressure drop calculations required by paragraph (b) of this section.

4) The rate of cargo transfer must not exceed the maximum allowable transfer rate as determined by the lesser of the following:

   i) Eighty (80) percent of the total venting capacity of the pressure relief valves in the cargo tank venting system when relieving at the set pressure required by §39.20-11(a) of this part;

   ii) The total vacuum relieving capacity of the vacuum relief valves in the cargo tank venting system when relieving at the set pressure required by §39.20-11(a) of this part;

   iii) The rate based on pressure drop calculations at which, for a given pressure at the facility vapour connection, or if lightering at the vapour connection of the vessel receiving cargo, the pressure in any cargo tank connected to the vapour collection system exceeds 80 percent of the setting of any pressure relief valve in the cargo tank venting system.

5) A cargo tank must not be filled higher than:
   i) 98.5 percent of the cargo tank volume; or
   ii) (2) The level at which an overfill alarm complying with §39.20-7 or §39.20-9(b)(2) of this part is set.

6) A cargo tank must not be opened to the atmosphere during cargo transfer operations except as provided in paragraph (g) of this section.

7) A cargo tank may be opened to the atmosphere for gauging or sampling while a tank vessel is connected to a vapour control system if the following conditions are met:

   i) The cargo tank is not being filled;
   ii) Except when the tank is inert, any pressure in the cargo tank vapour space is first reduced to atmospheric pressure by the vapour control system;
   iii) The cargo is not required to be closed or restricted gauged by Table 151,05 of part 151 or Table 1 in part 153 of this chapter; and

   iv) For static accumulating cargo, all metallic equipment used in sampling or gauging is electrically bonded to the vessel before it is put into the tank, and if the tank is not inerted, a period of 30 minutes has elapsed since loading of the tank was completed.

8) For static accumulating cargo the initial transfer rate must be controlled in accordance with Section 7.4 of the OCIMF, International Safety Guide for Oil Tankers and Terminals, in order to minimize the development of a static electrical charge.

9) If cargo vapour is collected by a facility that requires the vapour from the vessel to be inerted in accordance with 33 CFR 154.820(a) or (b), the oxygen content in the vapour space of each cargo tank connected to the vapour collection system must not exceed 8 percent by volume at the start of cargo transfer. The oxygen content of each tank must be measured at a point one meter (3.28 feet) below the tank top and at a point equal to one-half of the ullage. Where tanks have partial bulkheads, the oxygen content of each area of that tank formed by each partial bulkhead must be measured at a point one meter (3.28 feet) below the tank top and at a point equal to one-half of the ullage.

10) If the vessel is equipped with an inert gas system, the isolation valve required by §39.20-1(a)(6) of this part must remain closed during vapour transfer.

11) Unless equipped with an automatic self-test and circuit monitoring feature, each high level alarm and tank overfill alarm required by §39.20-7 or §39.20-9 of this part, on a cargo tank being loaded, must be tested at the tank for proper operation within 24 hours prior to the start of cargo transfer.

4.3 Oil Transfer Procedure

Oil transfer procedure (USCG 33 CFR 155.750(d))

The regulation require that the “oil transfer procedures” be posted where they can be easily seen or be readily available. These procedures must give the following information and retained on board under the title of CARGO OPERATION MANUAL (OIL TRANSFER PROCEDURE MANUAL).

a) A list of each product transferred to or from the vessel. It must be completed at each different port and posted in cargo control room.

b) A description of type of transfer system installed including:

i) A drawing of the piping, including the location of all valves, controls, pumps, vents and overflows.
ii) The location of the shutoff valve or other isolation device that separates any bilge or ballast system from the oil transfer system.

Vessels should have mounted on a bulkhead of the cargo control and pump the correct and updated piping diagram, including bunker system, as it is required in (2) a-b.

c) A description of and procedures for emptying the discharge containment system.

d) The number of persons required to be on duty during oil transfer operations. Under normal circumstances the following schedule represents the minimum requirements for licensed and unlicensed crew members during the following operations:

i) When loading cargo - One licensed officer, the pump man, two AB (Able-Body-seaman).
ii) When topping off - Two or more licensed officers, the pump man and two AB.
iii) When discharging - One or more licensed officers, the pump man and two AB.
iv) When COW or draining tanks - One or more licensed officers, the pump man and two AB.
v) When bunkering - Chief Engineer or one licensed Engine Officer, one unlicensed Engine department person. One AB should remain on deck watch for tending the vessel's moorings during the bunker operations.

e) The duties by title of each officer, person in charge, pump man, able seamen and any other person required for each oil transfer operation.

f) Procedures and duty assignments for tending the vessel's mooring and gangway during the transfer of oil.

g) Procedures for operating the emergency shutdown and communications.

h) Procedures for topping off tanks.

i) Procedures for ensuring that all valves used during the oil transfer operations are closed upon completion of transfer.

j) Procedures for reporting oil discharge into the water.

k) Procedures for closing and opening the vessel openings.

Note: Enclosed to this section there is a copy of the “Tank vessel integrity” that should be poste d together with the above oil transfer procedures.

OIL TRANSFER PROCEDURE MANUAL retained on board separately (Cargo Operation Manual) are amended incorporating above, as required by USCG 33 CFR Part 155.750(d).

OIL TRANSFER PROCEDURES (33 CFR 154.310-5)

Name of the Vessel: _____

Port: _____ Date: _____

a. The generic name of the cargo: _____

_____

b. The name of the cargo as listed in Table 30.25.1 of 46 CFR: _____

_____

_____

c. Description of the appearance and odor of the cargo: _____

_____

_____

d. Hazards involved in handling this cargo: _____

_____

_____

e Instructions for safe handling of the cargo: _____

_____

_____

f. The procedures to be followed if the cargo spills or leaks, or if a person is exposed to the cargo: _____

_____

_____

g. A list of fire fighting procedures and extinguishing agents effective with fires involving the cargo: _____

_____

_____

Signed by: _____

4.4 Tank Vessel Integrity

(a) Except as provided in paragraph (b) when vessel is underway or at anchor must have all closure mechanism on the following properly closed:

I. Expansion trunk hatches
II. Ullage openings
III. Sounding ports
IV. Tank cleaning openings
V. Any other tank vessel opening that maintains the sea worthy condition of the tank vessel and prevents the inadvertent release of oil in the event of a tank vessel accident

(b) No person may open any of the closure mechanism in paragraph (a) while the vessel is underway or at anchor except when authorized and supervised by a licensed officer.

In addition to above Rule/Regulation point of view, correct operation keeping the required position of valve to be carried out for which oil transfer procedure manual (cargo operation manual) retained separately to be referred.

4.5 Duty and responsibility

Description of duties by title

Person In Charge	Duties
A responsible officer for in cargo loading/unloading	In cargo control room 1. Order and supervise all Cargo loading/unloading operations. 2. Operate and check the oil discharge monitoring and control system. 3. Operate valves/pumps.
Crew/pump man	On deck and in pump room 1. Keep watch and ensure that the systems are in good order. 2. Assist for valve operation and follow the command from the officer in cargo control room. 3. Observe if cargo piping is leaked anywhere while cargo loading & unloading. 4. Visual inspection of the surface of ballast water 5. Observe cargo level on level gauging system.

A responsible officer must perform the duties to protect the environments in accordance with company policy of ENVIRONMENTAL PROTECTION & MARPOL 73/78.

4.6 Vessel Check List

First of all, a person in charge of a transfer operation utilizing vapour collection system must well notify this loading rate to all related person.

Before the transfer operation, all equipment should be function tested.

Check list here in this manual is a little different from those in cargo operation Manual (Oil Transfer Procedure Manual) since this manual mainly deals with operating and facilities for Vapour Emission Control only

PRE-ARRIVAL CHECKS AT TRANSFER OPERATION

NO.	ITEM
1.	Has terminal been notified?
2.	Are the H/V P/V valves checked that it will not remain open position?
3.	Are the isolating valves related to cargo loading positioned correctly?
4.	Is the inert gas isolating valve per each cargo tank in open condition?
5.	Is the common vent riser valve positioned in closed condition?
6.	Has high-high level alarm system been checked?
7.	Has the cargo monitoring system been checked?
8.	Has the pressure transmitter system been checked?
9.	Has the oxygen analyzing equipment been checked?
10.	Has the communicating system been checked and tested?
11.	In case where the terminal has a standard radio check, has this been completed and transmitted?

BEFORE CHECKS AT TRANSFER OPERATION

1.	Are all pre-arrival checks and condition in order?
2.	Has the transfer operation discussed with both ship and shore staff and is agreed plan readily available for easy reference?
3.	Has communication line between the deck, control station and control station/shore been set up and is it working properly?
4.	Has the transfer procedure been agreed by both ship and shore staff?
5.	Has the vapour main pressure equipment been checked?
6.	Has the high-high level alarm equipment been checked?
7.	Has the cargo monitoring equipment been checked?
8.	Has the oxygen equipment been checked?
9.	Has Inert Gas valve IG001 been checked closed - Before loading?
10.	Has Inert Gas valve IG001 been open - Before Discharging?

DURING THE TRANSFER OPERATION

1.	Is the cargo-loading rate maintained within maximum loading capacity?
2.	Is the pressure of vapour main line properly kept?
3.	Are all the relevant deck lines being frequently checked?
4.	Is a responsible person stationed in nominated position?

AFTER THE TRANSFER OPERATION

1.	Are relevant isolating valve positioned correctly? Open / Close position?
2.	Has Inert Gas valve IG001 been checked open - After loading? Has Inert Gas valve IG00l been checked kept open – After Discharging?

IMPORTANT!!

Before the VECS operation, IG001 valve to be closed for the separation / isolation of I.G plant / piping and VECS piping as required by USCG 46 CFR Part 39.20-1(a)(6).

---- This sentence have been described on the IGS manual retained on board separately, as required by USCG 46 CFR Part 32.53-85(b). ----

CARGO OIL TRANSFER PROCEDURES

M.T _____ Call Sign: _____

Person in charge of oil transfer is: Position _____ Name: _____

1) This vessel transfer: crude oil _____ Product: _____

2) This vessel has fixed oil discharge containment around cargo manifold, which can be drained to no. 3 cargo oil tank (P&S).

3) Oil transfer operations require (Number): _____ crewmen.

4) Duties of personnel during cargo handling:

Position	Duties
Chief Officer	- Conduct all cargo transfer operation in the CCR. - Ensure stress of the hull during all the time of cargo handling.
Second Officer ”A”	- Conduct chief officer’s order. - Check 02 in the cargo tank. - Check any leakage and mooring on deck.
Second Officer ”B”	- Same as 2nd officer ”A”
Pump man	- Closely contact officers during cargo handling. - Visit and check any leakage in pump room. - Check cargo pump bearing temperature.
Bosun	- Conduct Chief Officer’s order. - Upon order, attend mooring emergency towing.
Crew on duty	- Stand by around cargo manifold. - Observe deck/sea if leakage happened. - Check the visitors come to on board.

5) Person in charge of tending vessel’s line during oil transfer is:

Position: _____ Name: _____

6) Procedures for emergency shut down / communications:

_____

7) Procedures for topping off tanks or of normal filling:

_____

8) After transfer, ensure that all valves used during transfer operation are closed and IG main isolation valve to be open.

_____

9) If oil spill immediately stop the transfer and report to

a) Agent
_____
_____

b) U.S. Coast Guard
VHF Channel 16 or
Tel.: 1-180-424-8802

c) National Contact
(see SOPEP Manual,
Appendix 1

Note: Line diagram of vessel's oil transfer piping is engraved on cargo console.

Master M.T. : _____

5.1 Pressure Drop Calculation

Pressure drop calculation is carried out for following two cases as the most severe situation.

THIS PRESSURE DROP IS CALCULATED ON THE BASIS OF NO. 1 Cargo Tank (P), WHICH IS THE FARTHEST CARGO TANK FROM VAPOUR CONNECTING MANIFOLD.

- g ; Density of the vapour gas : 3.0 KG/M3
- Vapour growth rate : 1.25
- Maximum loading capacity per each segregation : 6,840 M3/H
- Maximum loading rate per each cargo tank : About 3,420 M3/H

(If two(2) tanks are engaged in each segregation)

- f ; Friction factor
- Re: Reynold's number [Re = (V x D) / v]
- V ; Velocity [M/S]
- V : Kinematics viscosity : 0.175×10^{-4} M^2 / S
- ε ; Pipe roughness height : 0.00004572 M
- L ; Pipe length [M]
- D ; Pipe inner diameter [M]
- K ; Loss coefficient

5.2 Major pressure loss for vapour collection pipe

$\triangle P_1 = (p \times V^2 \times f \times L) / (2 \times D)$

* Here, friction factor will be obtained through following formula.

$f = 1.325 / \{ [\ln (\varepsilon / 3.7D + 5.74 / Re^{0.9})] \}^2$

$\triangle H_1 = \triangle P_1 \times (0.102 \text{ MMAQ} / 1 \text{ Pa})$

Segment	***D(m)***	***L(m)***	***Q(m3)***	***V***	***f***	***dP***	***dH***
1~4	0.293	13.90	3420	14.13	0.0164	233.46	23.81
4~5	0.431	2.50	3420	6.53	0.0170	6.31	0.64
5~8	0.584	50.90	6840	7.11	0.0158	104.36	10.64
8~11	0.584	41.40	13680	14.23	0.0143	307.70	31.38
11~13	0.584	14.90	13680	14.23	0.0143	110.74	11.30
13~19	0.584	21.30	20520	21.34	0.0136	339.59	34.64
					74.9466	93.68	**112.42**

5.3 Minor pressure loss for valve and fitting

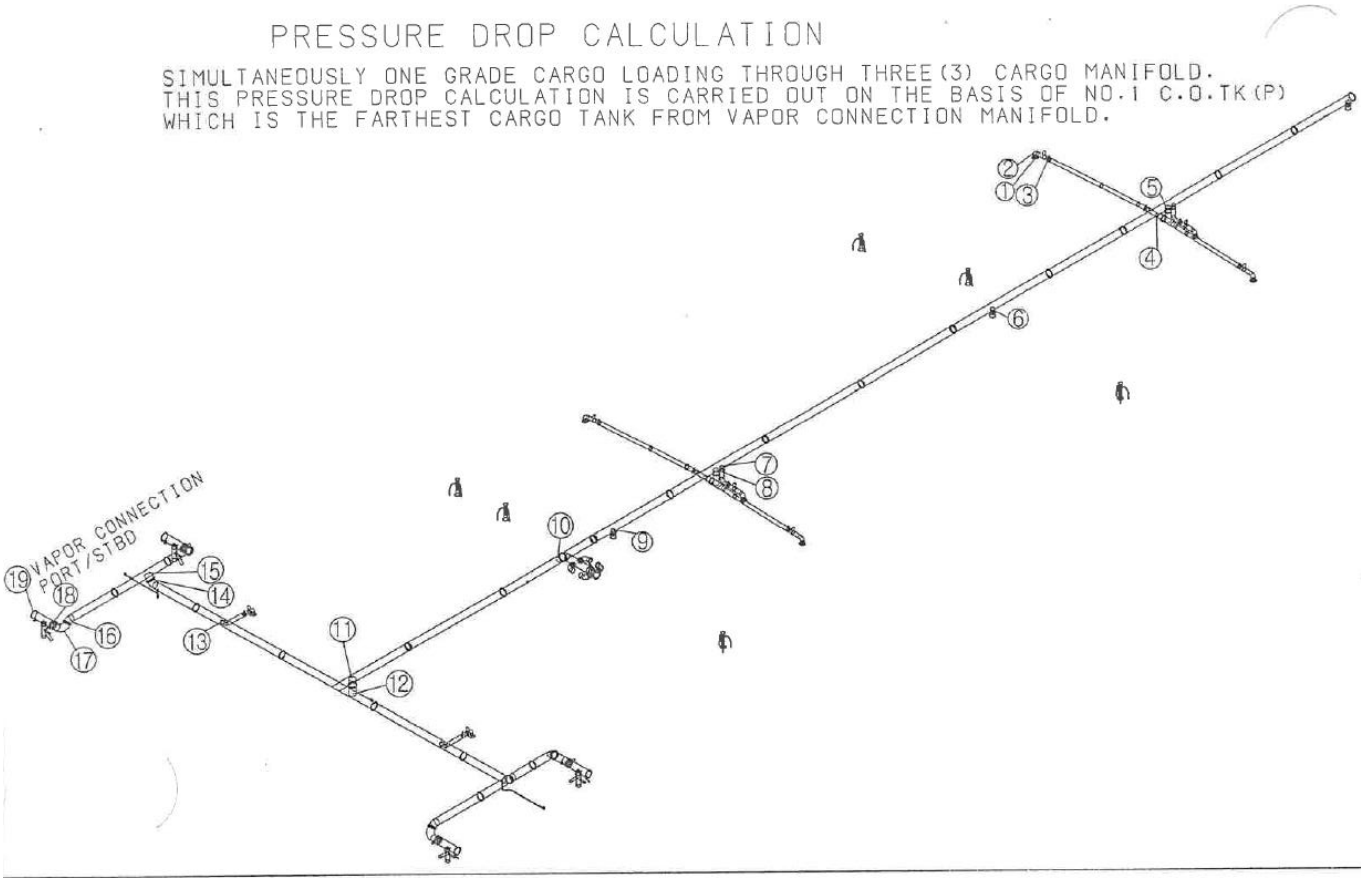
$\triangle P_t = K \times g \times V^2 / 2$

Point	***Description***	***K***	***V***	***dP***	***dH***
1	Entrance	0.50	14.13	149.78	15.28
2	90 D Elbow (300A)	0.24	14.13	71.90	7.33
3	Butterfly valve (300A)	0.28	14.13	83.88	8.56
4	Reducer(450A X 300A)	0.26	6.53	16.64	1.70
5	Tee(600A X 450A)	0.21	7.11	15.94	1.63
6	Tee(600A X 350A)	0.21	7.11	15.94	1.63
7	Tee(600A X 300A)	0.21	14.23	63.77	6.51
8	Tee(600A X 350A)	0.21	14.23	63.77	6.51
9	Tee(600A X 350A)	0.21	21.34	143.49	14.64
10	Tee(600A X 600A)	0.40	21.34	273.32	27.88
11	Tee(600A X 600A)	0.40	21.34	273.32	27.88
12	Tee(600A X 600A)	0.40	21.34	273.32	27.88
13	Tee(600A X 300A)	0.21	21.34	143.49	14.64
14	45 D Elbow (600A)	0.14	21.34	95.66	9.76
15	Tee(600A X 600A)	0.21	21.34	143.49	14.64
16	45 D Elbow (600A)	0.19	21.34	129.83	13.24
17	90 D Elbow (600A)	0.24	21.34	163.99	16.73
18	Butterfly valve (600A)	0.28	21.34	191.32	19.52
19	Vapor connection	0.38	21.34	259.65	26.48
TOTAL			174.93	218.66	**262.40**

Total minor pressure loss: **262.40 MMAQ**

TOTAL PRESSURE LOSS ($\triangle P_1 + \triangle P_t$**)**

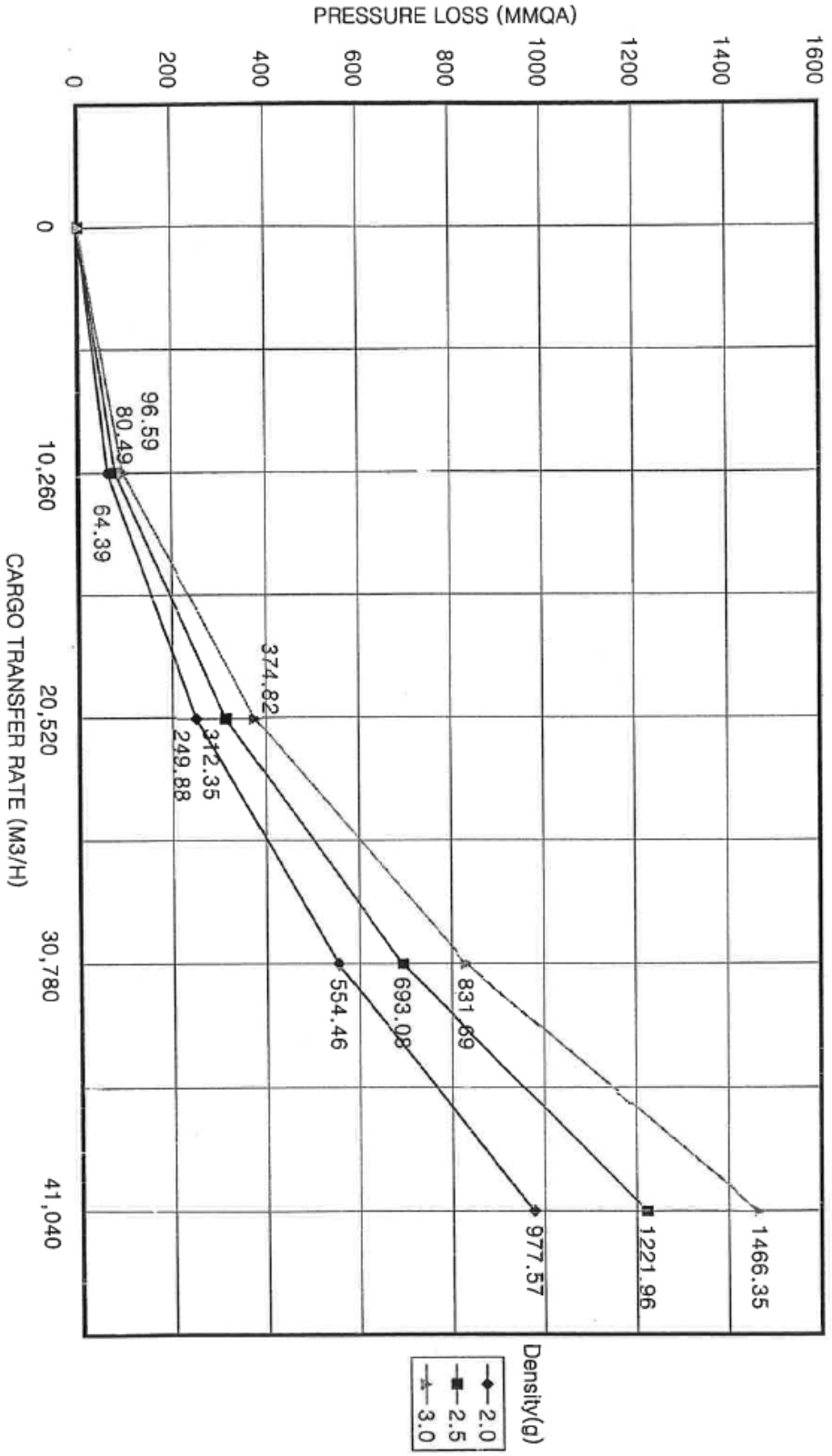
$\triangle$ H = 112.42 + 262.40 = 374.82 MMAQ


PRESSURE DROP CALCULATION
SIMULTANEOUSLY ONE GRADE CARGO LOADING THROUGH THREE(3) CARGO MANIFOLD.
THIS PRESSURE DROP CALCULATION IS CARRIED OUT ON THE BASIS OF NO.1 C.O.TK(P)
WHICH IS THE FARTHEST CARGO TANK FROM VAPOR CONNECTION MANIFOLD.
VAPOR CONNECTION PORT/STBD
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19

Chapter 6 – Pressure Drop Curve for Vapour Line

Pressure drop curve for vapour line on next page shows pressure drop - loading capacity for easy and quick reference according to piping installed onboard (Chapter 8 of this manual - Isometric drawing of vapour line) and pressure drop calculation (Severe case was calculated on Chapter 5 of this manual).

GRAPH FOR PRESSURE DROP RELATED TO CARGO TRANSFER
(SIMULTANEOUSLY ONE GRADE CARGO LOADING THROUGH THREE CARGO MANIFOLD)



Alarm Time Calculation

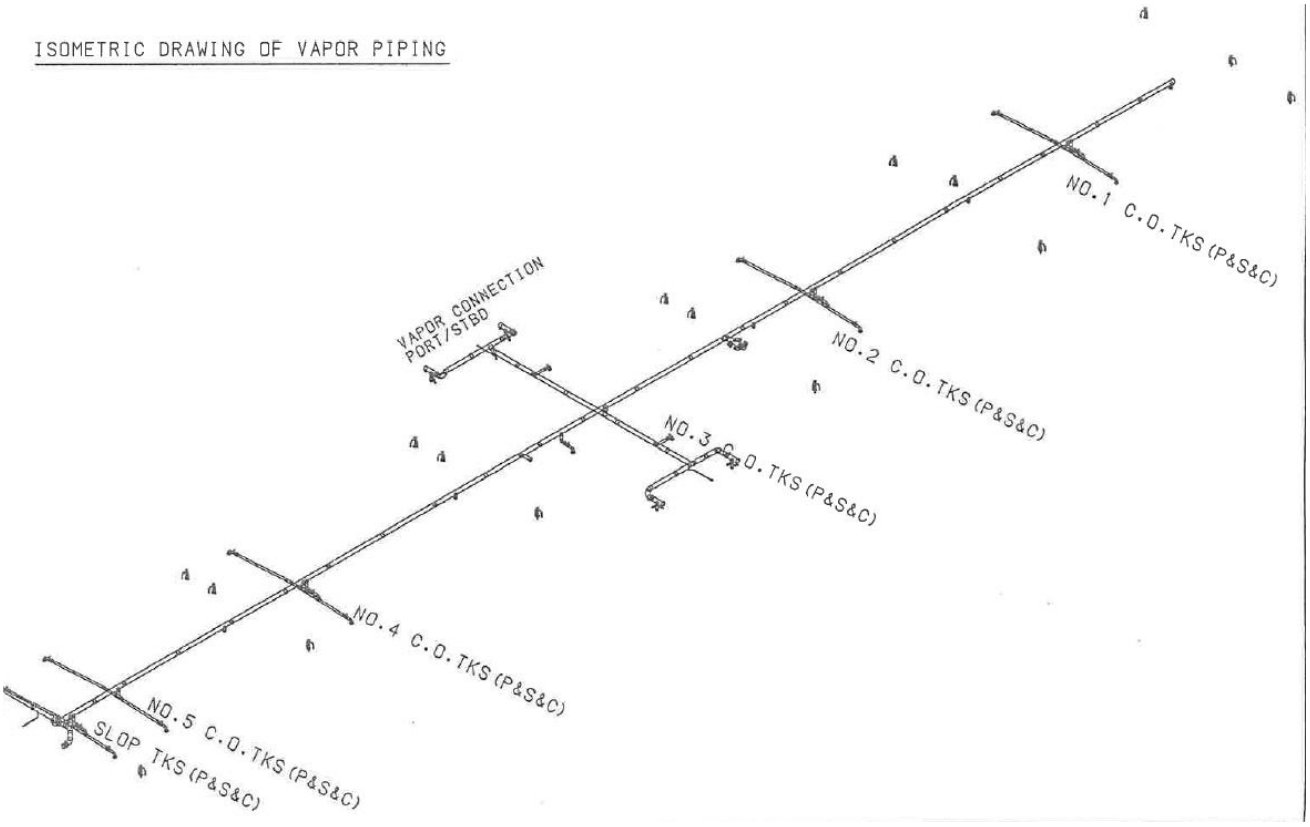
TANK NAME	TANK HEIGHT	100% VOL	SET HEIGHT (FROM B/L)	SET 98% VOL	TIME (sec)
No. 1(P/S)	29.51	16586.7	31.41	16255.0	349.2
No. 2 (P/S)	29.14	20611.0	31.27	20198.8	433.9
No. 3 (P/S)	29.14	20611.0	31.27	20198.8	433.9
No. 4 (P/S)	29.14	20611.0	31.27	20198.8	433.9
No. 5 (P/S)	29.14	14535.5	31.35	14244.60	306.0
No. 1 (C)	29.70	28237.9	31.85	27673.1	594.5
No. 2 (C)	29.70	32537.1	31.83	31886.4	685.0
No. 3 (C)	29.70	32537.1	31.83	31886.4	685.0
No. 4 (C)	29.70	32537.1	31.83	31866.4	685.0
No. 5 (C)	29.70	32526.7	31.83	31876.2	684.8
SLOP (P)	23.85	3910.60	31.47	3832.4	82.3
SLOP (S)	23.85	4035.2	31.46	3954.5	85.0
TOTAL		518553.4		508182.3	

Notes:

1. Times means period in second from overfill alarm to overflow less than 3,420 M3/H per each cargo tank. (20,500 M3/H from shore when 3 segregation, 2 tanks for each segregation are engaged)

2. Topping up at reduced capacity must be carried out at final stage of cargo loading.

Attached on next page shows isometric view of vapour piping installed onboard which commonly used for inert gas distribution piping. Calculations on Chapter 5 of this manual and pressure drop curve on Chapter 6 of this manual are made based on the piping on next page.


ISOMETRIC DRAWING OF VAPOR PIPING
NO.1 C.O.TKS (P&S&C)
VAPOR CONNECTION PORT/STBD
NO.2 C.O.TKS (P&S&C)
NO.3 C.O.TKS (P&S&C)
NO.4 C.O.TKS (P&S&C)
NO.5 C.O.TKS (P&S&C)
SLOP TKS (P&S&C)

At alarm condition related to Vapour Emission Control System, following emergency procedure shall be followed.

Alarm Condition	Hazards associated with alarm condition	Emergency Procedure
- Cargo tank high level alarm (95% volume) - Tank overfill alarm (98 % volume)	Overfill and spillage of cargo. Cargo tank over pressurization and under pressurization. Fire, explosion and detonation.	1. Reduce the cargo transfer rate by closing the cargo valves. 2. Close the manifold valve. 3. Contact with terminal officer and/or the person in charge of oil transfer of service vessel for system shut down.
- Vapour collecting line high pressure alarm (1200 mmWG) - Vapour collecting line low pressure alarm (100 mmWG)		
- Oxygen High alarm (8% volume)		

This operation and equipment manual for vapour emission control system is in compliance with the training program required by USCG 46 CFR 39.10.11.

10.1 A person in charge of a transfer operation utilizing a vapour collection system must have completed a training program covering the particular system installed on the vessel. Training must included drills or demonstrations using the installed vapour control system covering normal operations and emergency procedures.

10.2 The training program required by paragraph (a) of this subpart must cover the following subjects:

10.3 Vessel is to use the below form as a checklist when conducting the training for the crew member.

10.4 Newly joined officers/crew involved in the VOC operation shall undergo the training programmes in earliest opportunity.

SUBJECT	CONTENT IN THIS V.O.C. MANUAL
(1) Purpose of a vapour control system	See Chapter 3.5 - Vapour Emission Control System – Design and Specification
(2) Principles of the vapour control system	See Chapter 3.5 - Vapour Emission Control System – Design and Specification
(3) Components of the vapour control system	See 3 – Cargo Tanks and Equipments
(4) Hazards associated with vapour control system	- Overfill and spillage of oil - Cargo tank over pressurization - Cargo tank under pressurization - Fire, explosion and detonation
(5) Coast Guard regulations in this Chapter	See Chapter 9 – Emergency procedure
(6) Operating procedures, including I. Testing and inspection requirements II. Pre-transfer procedure III. Connection sequence IV. Start-up procedures V. Normal operations	See Chapter 4 – Oil Transfer Procedures See Chapter 3 – Cargo Tanks and Equipment See 4.2 USCG CFR regulations on transfer procedures and Vapour emission control
(7) Emergency procedures	See Chapter 9 – Emergency procedure

VOC MANAGEMENT TRAINING RECORD

Vessel: _____ Date: _____

Port / Location: _____ Purpose of training: _____

The following crew members whose work or duty and responsibility onboard is related to Management, handling and/or for the release of gas/vapour have respectively received special training and instruction in accordance to the parameters set forth in 46 CFR 39.10.11.

Description and summary of the briefing and training conducted:

No.	Training Scope	Tick (✓)
1.	Purpose of a vapour control system	
2.	Principles of the vapour control system	
3.	Components of the vapour control system	
4.	Hazards associated with the vapour control system	
5.	Coast Guard regulations in VOC	
6.	Operating procedures, including: (i) Testing and inspection requirements (ii) Pre-transfer procedures (iii) Connection sequence (iv) Start-up procedures (v) Normal operations	
7.	Emergency procedures.	
8.	Q & A	

Record of crew attended this training.

No.	Name	Rank	Date	Signature

Training Officer: _____ Master: _____

Signature: _____ Signature: _____

11.1 Record keeping is necessary in order to document compliance with the requirements of the management plan and, potentially, the extent of release of gases from the crude oil cargo tanks.

11.2 The appropriate record keeping is as follows:

a. The target or minimum pressure within the tank gas/vapour system for the specific voyage.

b. A record of the time and pressure within the tank gas/vapour system before the release takes place.

c. A record of the time and pressure within the gas/vapour system after the release has been completed.

11.3 The foregoing data and information may be compiled by the ship's management company or operators in order to assess or quantify the extent or degree of VOC release.

11.4 Vessel is to use the below sample form to complete the record of the gas/vapour manually released to the atmosphere.

GAS/VAPOUR RELEASE RECORD

Vessel: _____ **Date:** _____

Location: _____ **Voyage No.** _____

Cargo: _____ **Type of Operation:** _____

Tank No.	Minimum Pressure	Before Gas/Vapour Release		After Gas/Vapour Release	
		Time	Pressure	Time	Pressure

Officer: _____ **Master:** _____

Signature: _____ **Signature:** _____

12.1 Qualification of Designated Person

A person should be designated to assume overall charge of the VOC management on board the ship.

The designated person should preferably have:

1) At least one year of experience on crude oil tankers where his or her duties have included all cargo handling operations relevant to VOC management. In the absence of experience with VOC management, he or she should have completed a training programme in VOC management as specified in the VOC management plan;

2) Participated at least twice in cargo loading operations, Crude Oil Washing Operations and transit where VOC management procedures have been applied, one of which should be on the particular ship or a similar ship in all relevant aspects, for which he or she is to undertake the responsibility of VOC management; and

3) Full knowledge of the contents of the VOC management plan.

12.2 Designated Person of the Vessel

The designated person of the vessel is as the following:

・The designated person･･･Chief Officer.

The designated person should notify personnel engaged in cargo handling of crude oil of matters stipulated in this plan as well as train them and may assign appropriate personnel to carry out the relevant tasks.

The following drawings and descriptions are to be referred when using this manual:

13.1 General Arrangement

13.2 Piping Diagram of Cargo System

13.3 Piping Diagram of Ballast System

13.4 Piping Diagram of Cargo Tank Vent/Inert Gas System

13.5 Piping Diagram of Crude Oil Washing

13.6 Specification for the COW machine

13.7 Piping Diagram of Vapour Emission/High High level alarm System

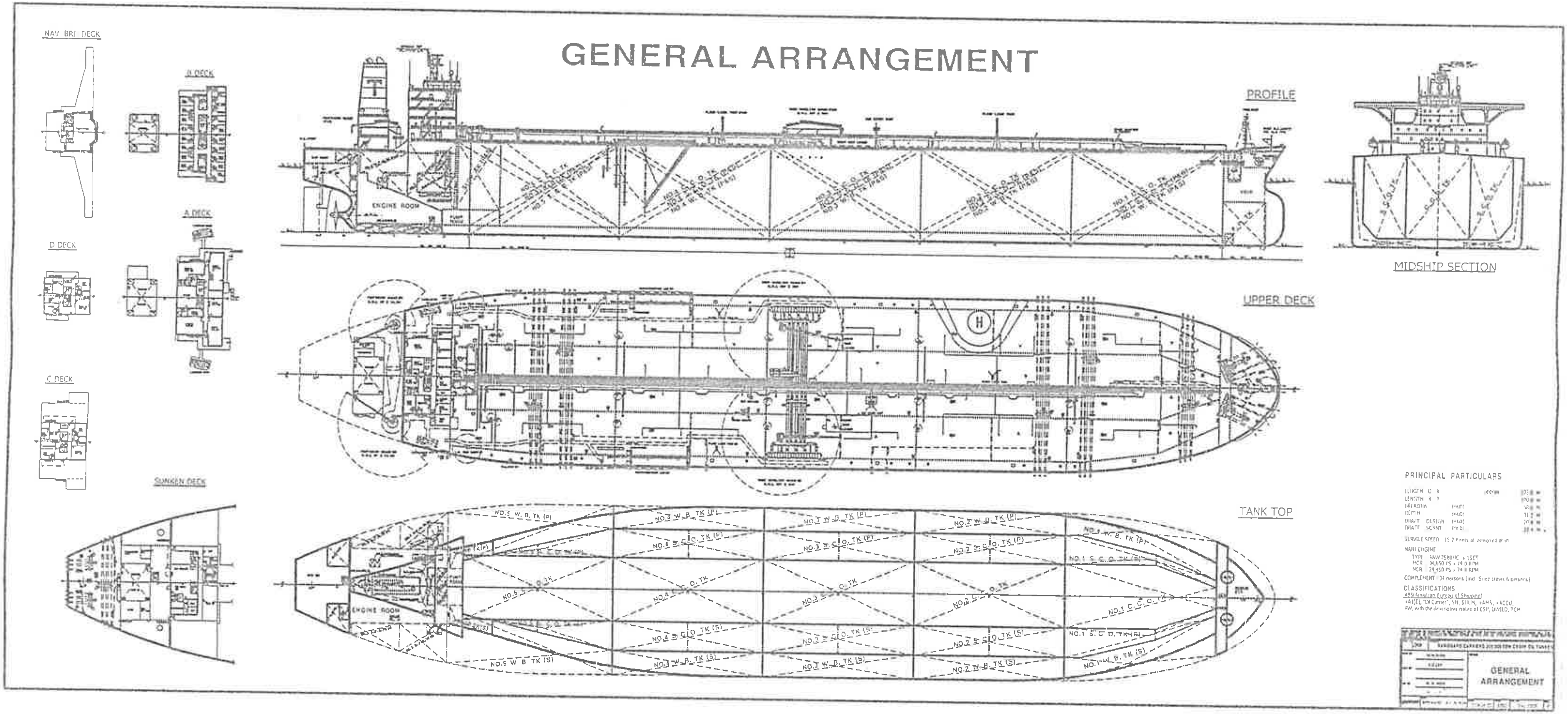
13.8 Detail of Electric earth bonding installation

13.9 Detail of Vapour connection – Manufacture Drawing

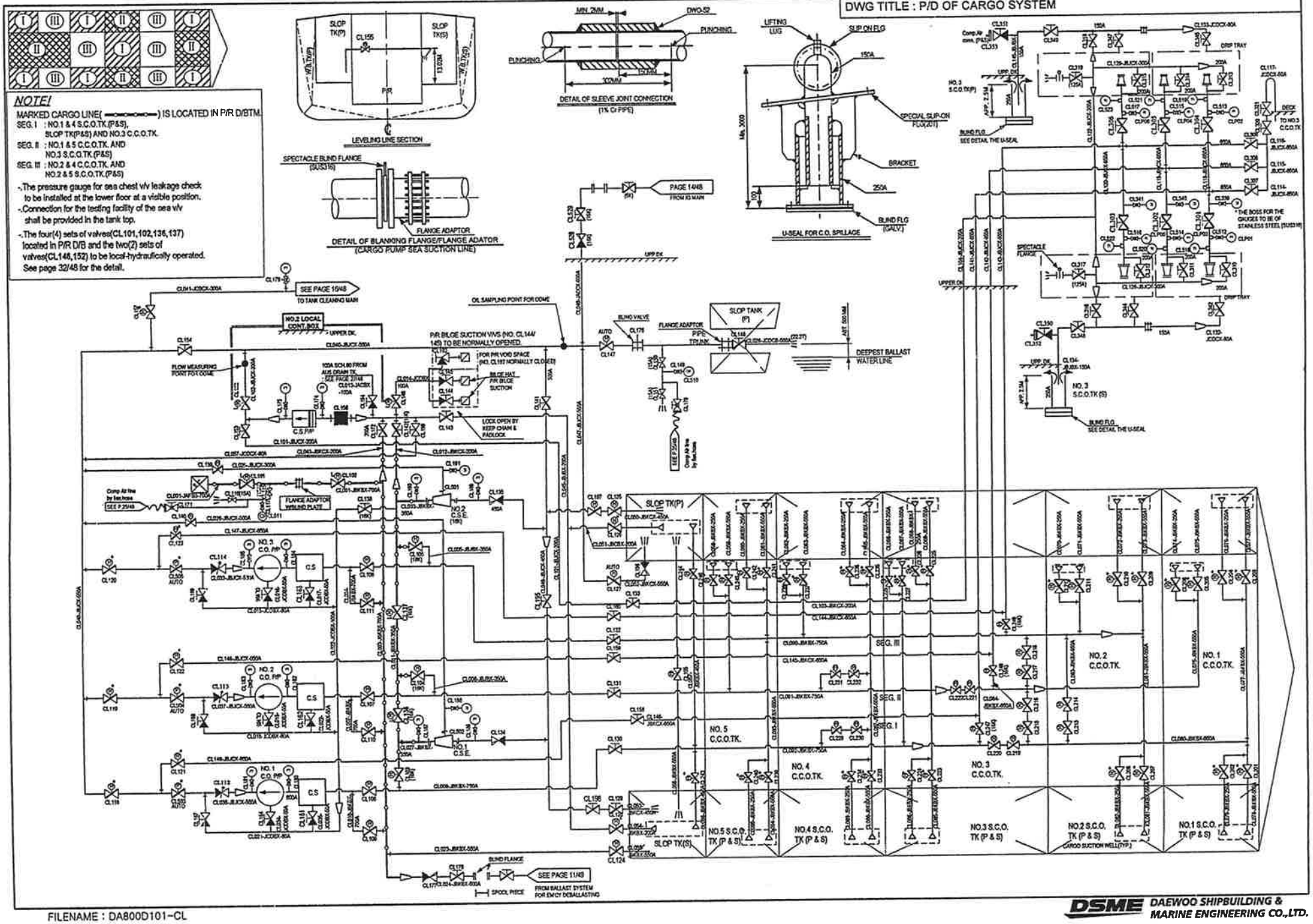
13.10 Marpol Annex VI, Regulation 15 – Volatile organic compounds

13.11 Annex 10 of IMO Resolution MEPC 185(59)

GENERAL ARRANGEMENT



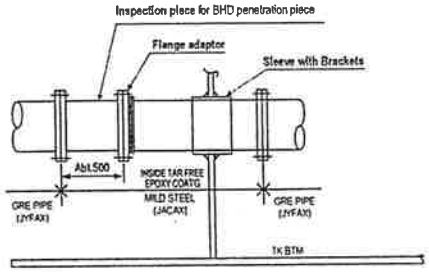
DWG TITLE : P/D OF CARGO SYSTEM



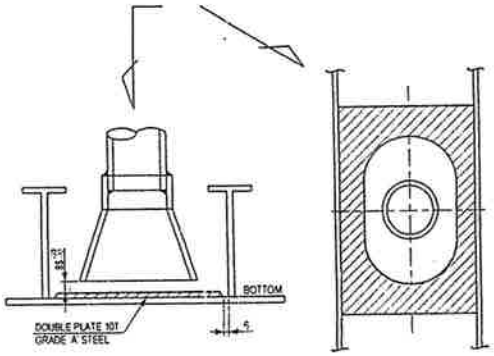
DWG TITLE : P/D OF BALLAST SYSTEM

NOTE!

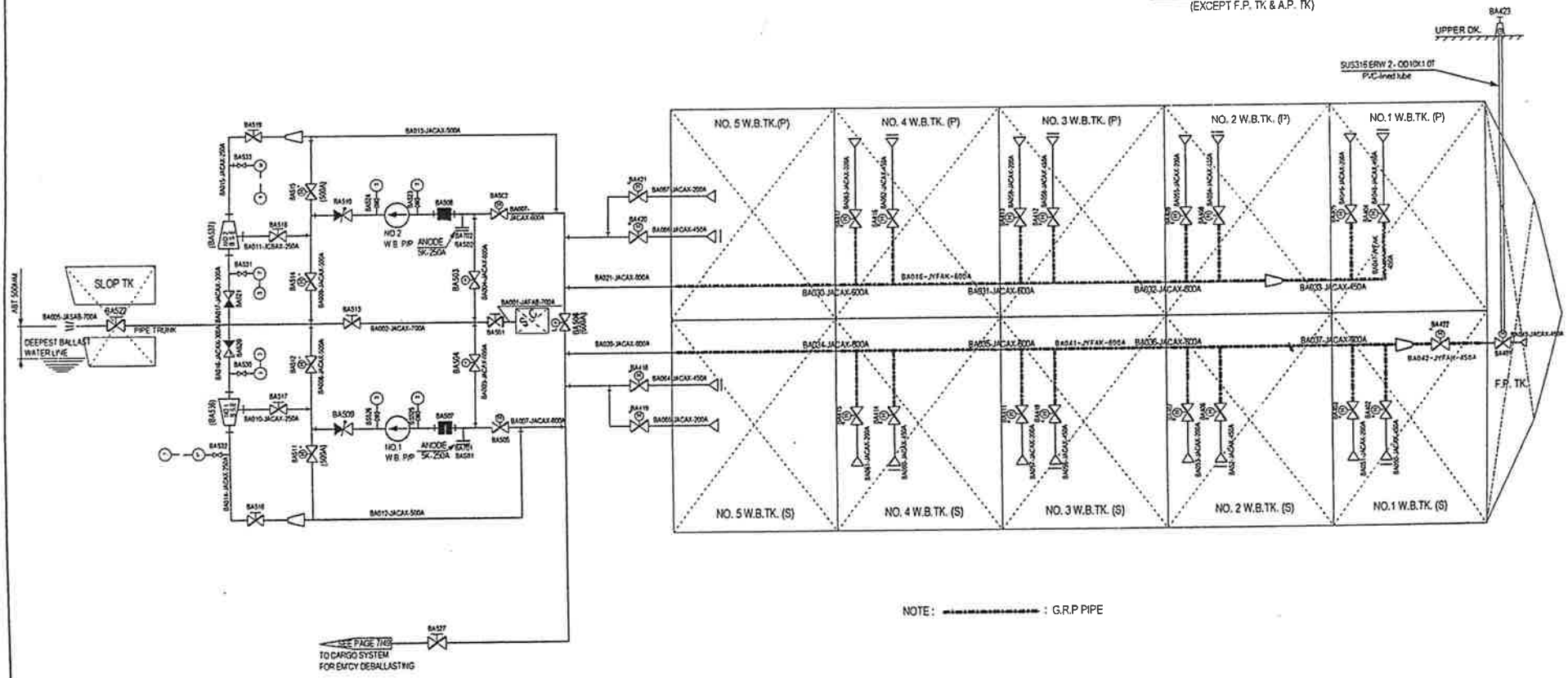
-. The valve(BA506) located in P/R D/B to be local-hydraulically operated.
See page 32/48 for the detail.



TYP. DETAIL OF BHD PENETRATION

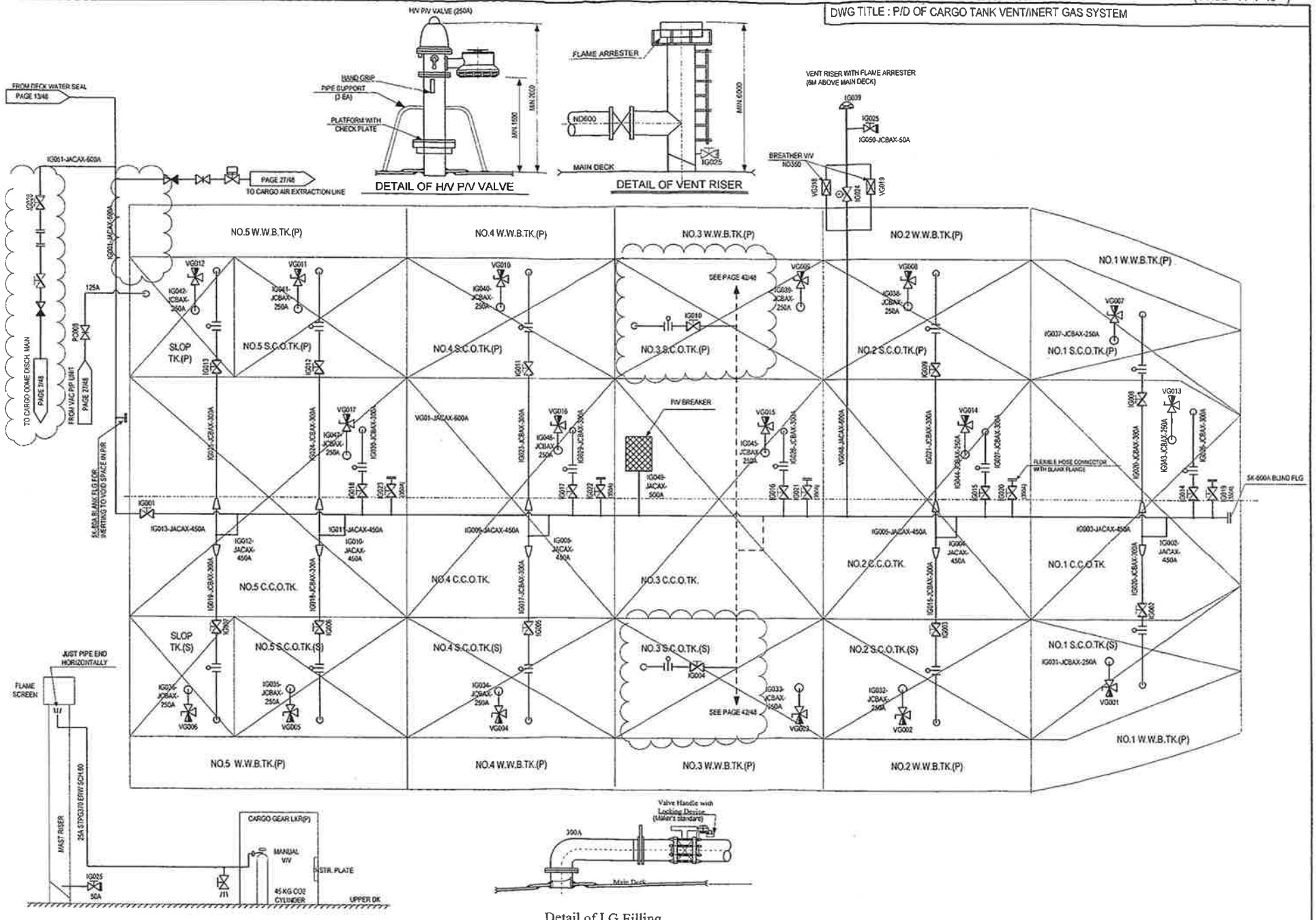


450A SUCTION BELLMOUTH
(EXCEPT F.P. TK & A.P. TK)



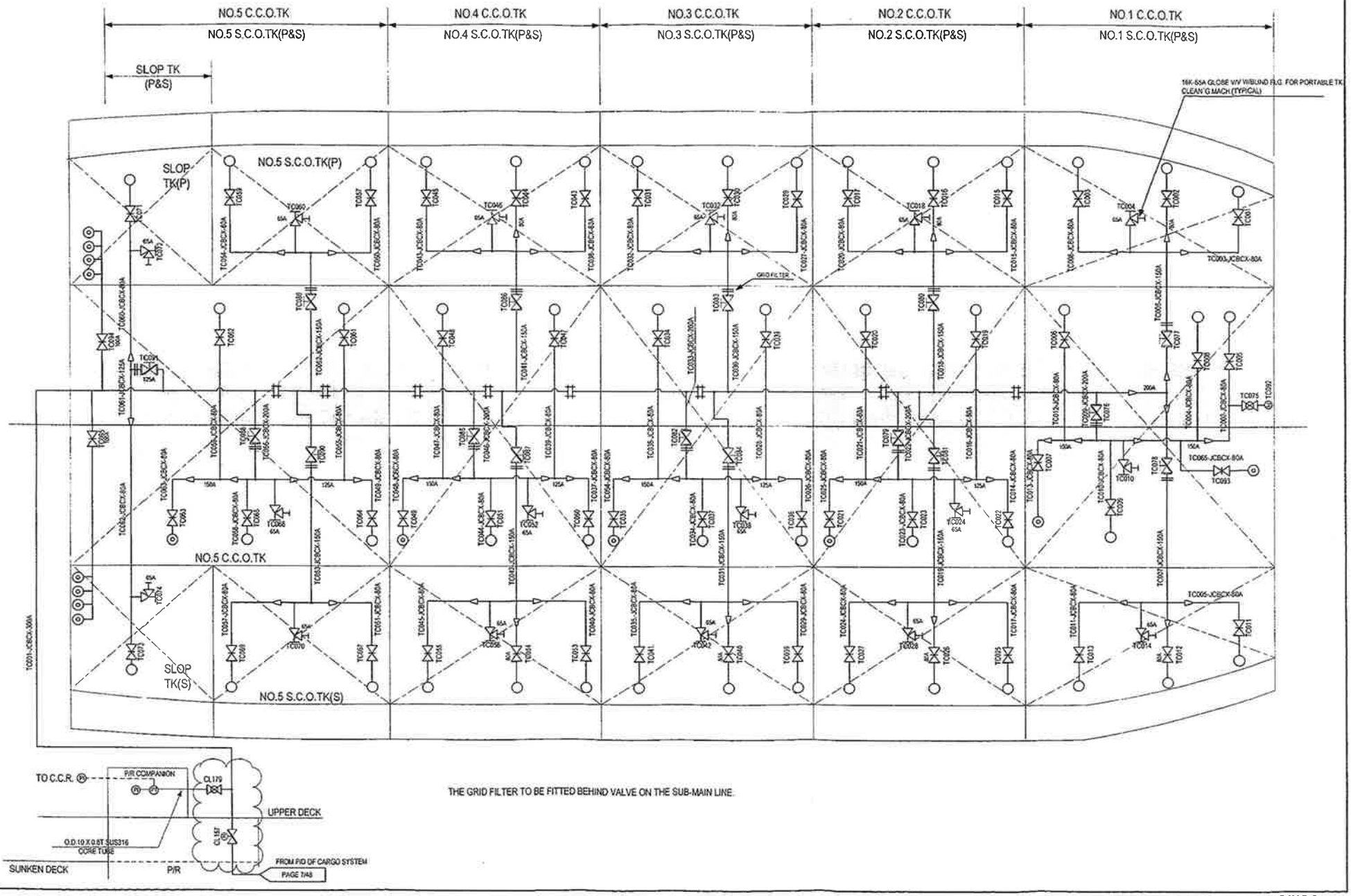
NOTE: ——— : G.R.P PIPE

DWG TITLE : P/D OF CARGO TANK VENT/INERT GAS SYSTEM



FILENAME : DA800D101-IG,VG

DWG TITLE : P/D OF C.O.W AND TANK CLEANING SYSTEM



THE GRID FILTER TO BE FITTED BEHIND VALVE ON THE SUB-MAIN LINE.

13.6 Specification for the COW Machine and washing system

1. Particulars of tank cleaning machines.

a) Type of machines on each tank.

Cargo Tank	No. and Type of Washing machine
No. 1,2,3,4 cargo oil tank (P&S)	Three (3) sets “SC90T2” type
No. 5 cargo oil tank (P&S)	Two (2) sets “SC90T2” type
No. 1 cargo oil tank (center)	Four (4) sets “SC90T2” type & Two (2) sets”SC45TW” type
N0. 2,3,4,5 cargo oil tank (center)	Four (4) sets “SC90T2” type & One (1) set “SC45TW’ type
Slop tank (P & S)	One (1) set “SC90T2” type & Four (4) sets”SC45TW” type

b) Particulars of machine.

Machine Parameter	SC90T2 type	SC45TW type
Operating pressure	8 kg/cm2	8 kg/cm2
Dia of nozzle	30 mm	2x18 mm
Rate of discharge	90M3/h	50 M3 /h
Effective washing radius	36M	22 M
Gun pipe length	3.5M	Submerged
Nozzle operation angle	180° - 0° - 180°	360°
Manufacturer	Scanjet Marine AB in Sweden	

c) Note:

For the detail information of the tank cleaning machine, see the maker’s final drawing, “OPERATING, SERVICE AND INSTRUCTION MANUAL”.

2. Washing system

a) The ship is provided with a separate 300A COW line and branched to each washing machine. Any cargo pumps can supply either cargo oil or seawater to washing main line through crossover line on cargo pump discharge in aft pump room.

The cargo tanks and slop tanks are fitted with tank cleaning machines as mentioned in the above table. The type SC90T2 is deck mounted programmable single nozzle type and the type SC45TW is submerged non-programmable twin nozzle type.

Both of these washing machines are manufactured by Scanjet in Sweden.

b) The movement of the nozzle can be set to work between any angle from 00 to 180° (SC90T2) and bottom cleaning machine is set to work only at 360° (SC45TW - Non-programmable type).

c) Both the SC90T2 and SC45TW tank-cleaning machines have integral drive units that are powered by the force of the washing fluids. The method of verification for rotation is sound patter for submerged machine.

The SCANJET SC90T2, fully programmable, single nozzle tank cleaning units are flange mounted on the tank top or deck. Movement of the nozzle is fully controlled by integrated turbine driven control units, via a central turning and lifting rod in the cleaning unit.

The nozzle movement is in principle a rotation in the horizontal plane, combined with a very slow vertical movement. This means that the nozzle performs helical patterns

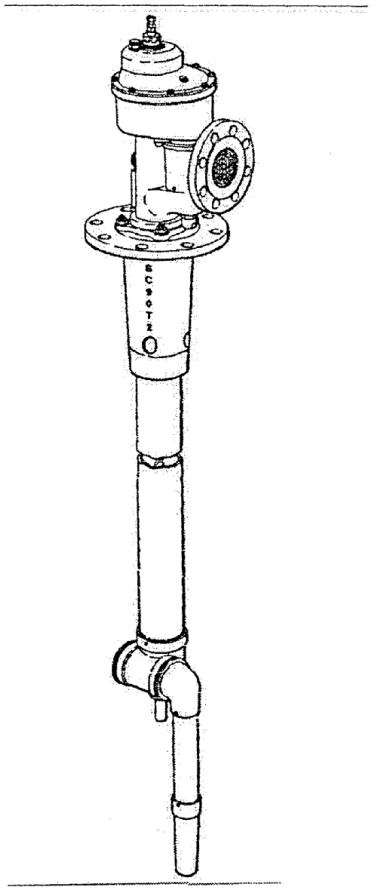
With the two (2) adjustable stops, the nozzle can be programmed to wash between desired vertical angles. The nozzle can be preset to start in any vertical position by manual cranking.

d) The minimum line pressure for crude oil washing is 8 bars. Normal working pressure is 9 bars. During the washing process the maximum permissible tank oxygen level required for safe COW operation is 8 percent by volume.

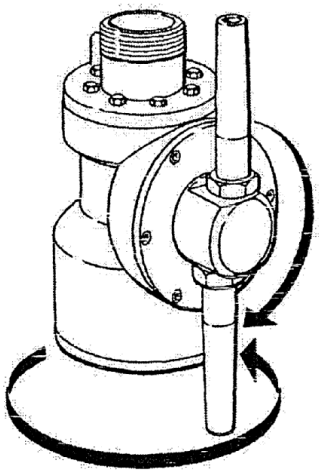
e) Crude oil washing must only be carried out when the oxygen level in the tank is less than 8 percent. This is the maximum permitted level.

f) Diagram of the Tank cleaning machine

SC90T2



SC45TW



SCANJET TANKCLEANING

Page 5 (37)

SC 90T2-CRUDE-02

WORKING PRINCIPE

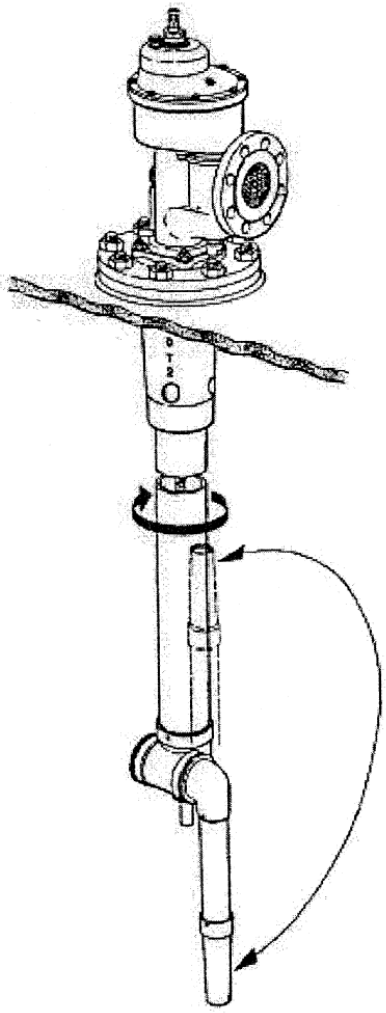
The cleaning media comes from the supply line onboard the vessel and enter into the inlet housing and passes the vertical turbine, which drives the driving unit.

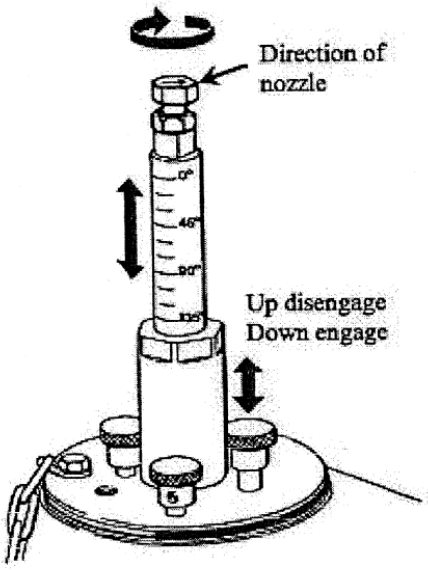
The cleaning media continue through the main pipe to the nozzles and then out in the tank.

The driving unit will rotate the main pipe and elevate the nozzle and will hereby clean the tank in a spherical pattern. The rotation speed is controlled by the rotation speed of the turbine and could easily be set to desired speed.

The rotation of the main pipe and the elevation of nozzle are indicated on the scale on the lifting rod.

The elevation per revolution (Pitch) for the nozzle can be set to different pre-programmed values by means of push or pull the program knob. (See below).





SCANJET MARINE AB, P.O. Box 2, S-275 21 SJÖBO, Sweden
Telefax no. +46 (0)416 511 656, Telephone no. +46 (0)416 513 100

g) The complete crude oil washing system has been inspected and approved by the administration and no alterations may be made to the system or any part of the system without the approval of the administration.

Cargo tanks shall be inspected after crude oil washing in accordance with the requirements of the revised specifications and met the required standards of cleanliness being essentially free of oil clingage and deposits.

The surface of the departure ballast shall be examined in accordance with the requirements of the revised specifications, and was found to be satisfactory.

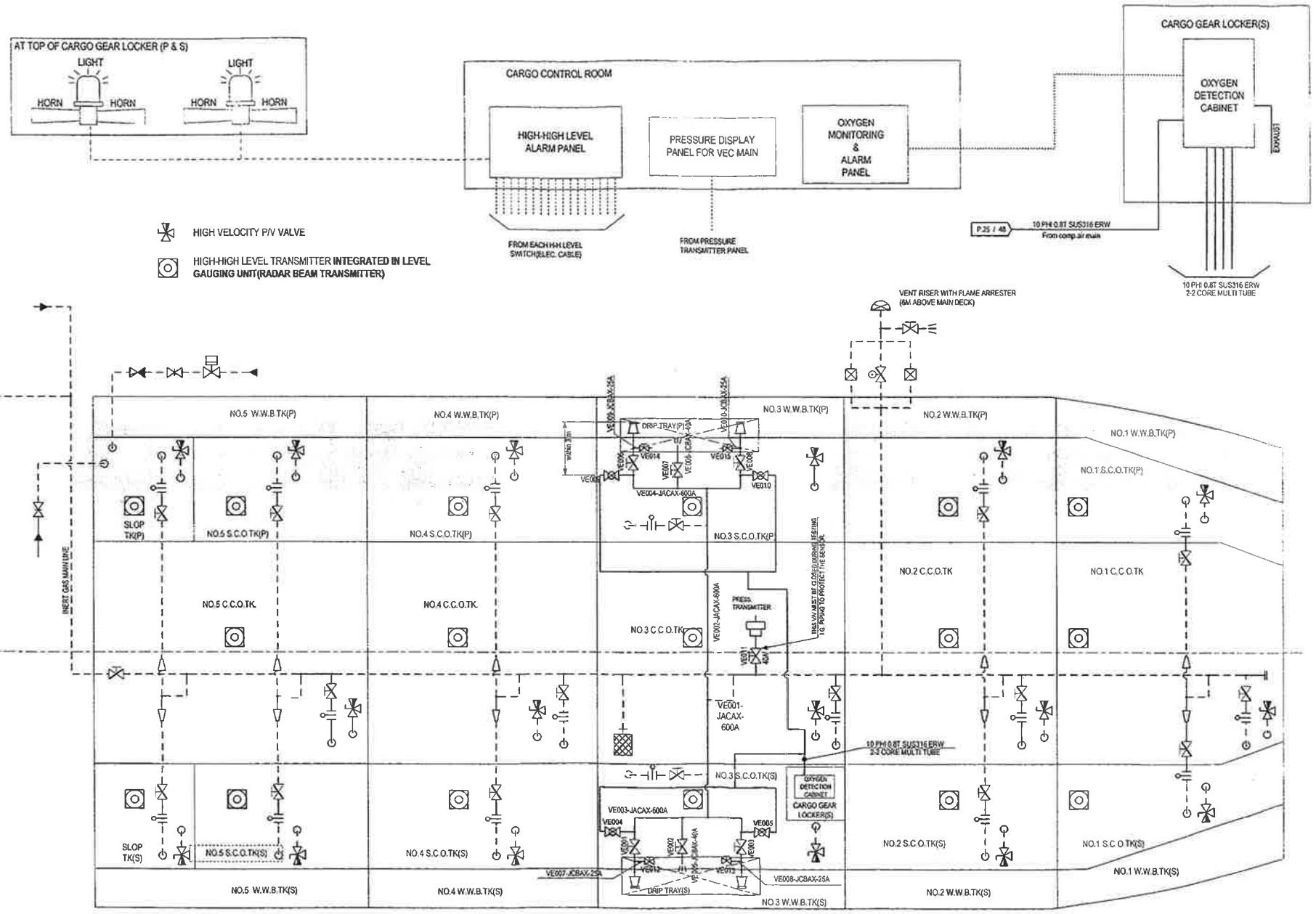
h) The procedure for computing the ratio of the volume of oil on top of the total departure ballast water to the volume of tanks that contains this water is described below:

Tank Number	Port, Starboard	Total tank volume (Cu.m)	Ullage of ballast water (measured to top of oil layer) (m)	Oil thickness (mm)	Volume of oil (cu.m)
X		Vx	Ux	tx	vx
	Total	V		Total	v

- Determine the thickness of the oil layer on the ballast water (tx).
- Using the tank capacity tables:
  - Determine the aggregate volume (100%) of all tanks that contain departure ballast (V).
  - Determine the volume of the ballast water and oil layer in each tank from the ullage (Ux).
  - Determine the volume of ballast water in each tank from the ullage plus the thickness of the oil layer (Ux + tx).
- Subtract the value obtained in (Ux + tx) from the value of (Ux) for each tank and add the resultant values together to obtain the total volume of oil (v).
- The ratio of the volume of oil on top of the total departure ballast water to the total volume of tanks containing departure ballast water = v/V.

i) There is no part of the crude oil washing system in the machinery space.

DWG TITLE : P/D OF VAPOR EMISSION AND HIGH LEVEL ALARM SYSEM



FILENAME : DA800D101-VE

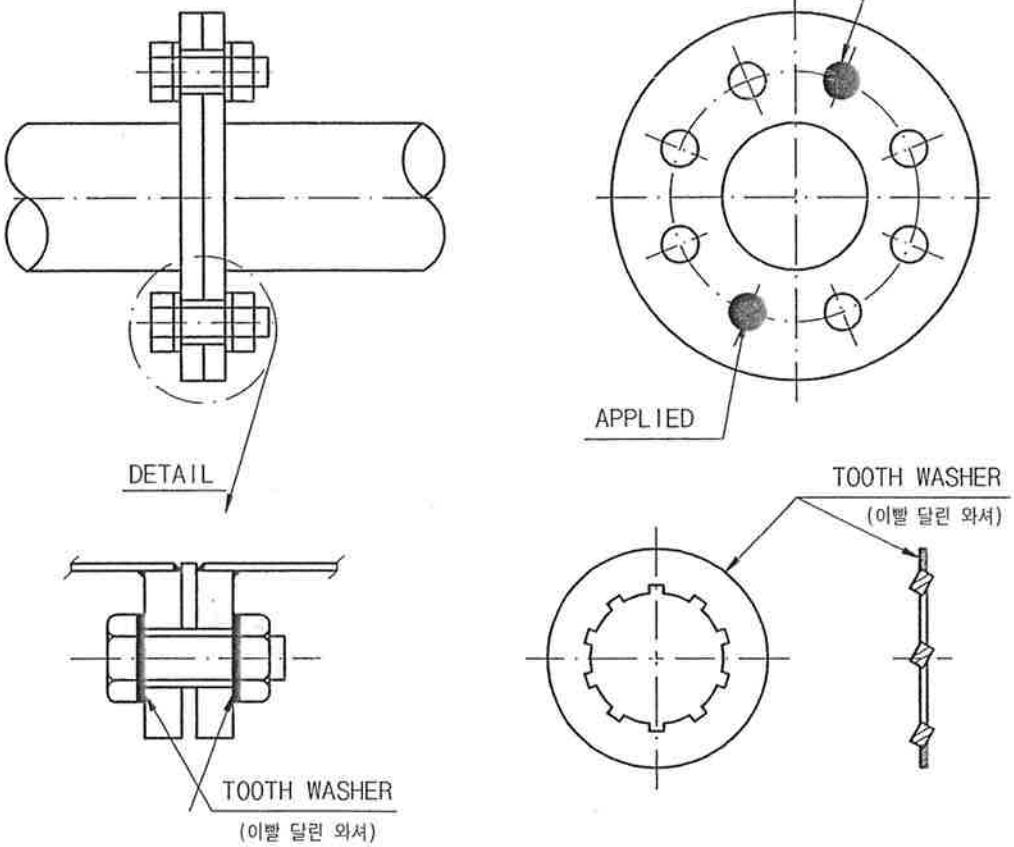
Printed by DSME 선장해군출계실,군행대,2007-03-16 14:01

DSME DAEWOO SHIPBUILDING & MARINE ENGINEERING CO.,LTD.

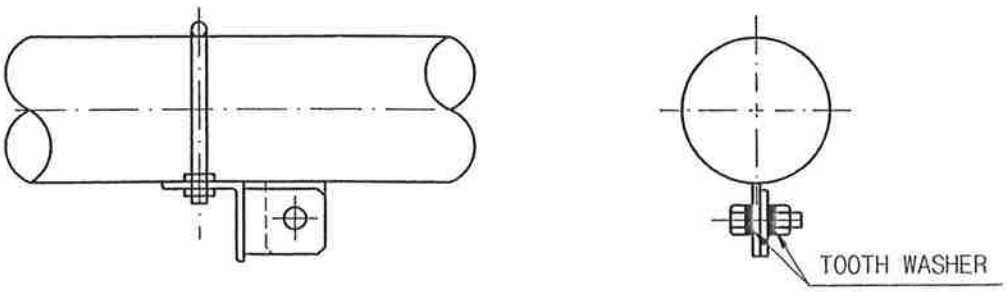
DSME	STANDARD NAME 4.15 ELECTRIC EARTH BENDING INSTALLATION	DSE Enactment Date 19 . . . Revision Date 19 . . . ( )

4.15.1 FLANGE CONNECTION OF CARGO, CRUDE OIL WASHING, I.G LINE, V.E.C. LINE, E.C.P. LINE
(EXCEPT DRESSER COUPLING)

(화물유관과 탱크세척유관의 플렌지 연결부 단, 드레서 케플링 연결부 제외)



4.15.2 FIXED POINT OF CARGO & TK CLEANING LINE
(화물유관과 탱크세척유관의 고정부)

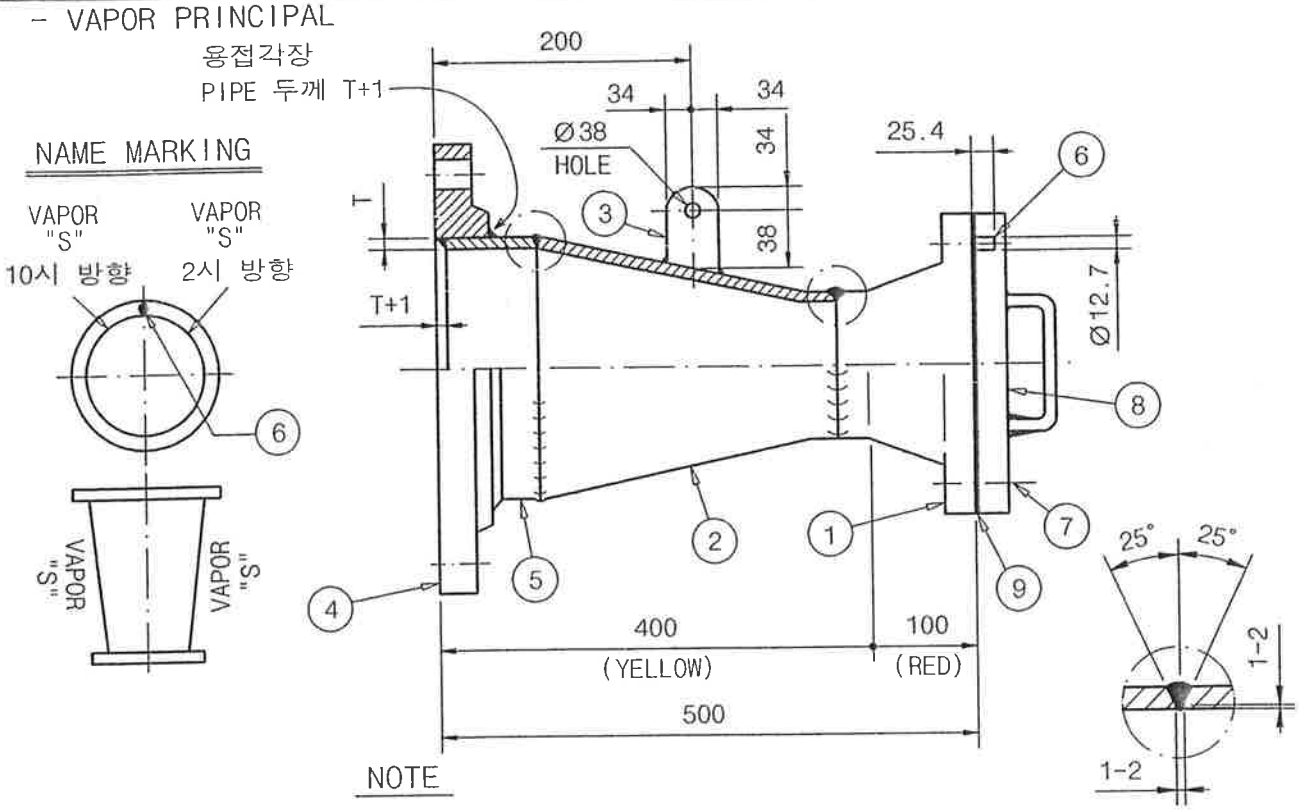


- NOTE -

- FOR NON PAINTED PIPE OF OUTSIDE, NO EARTH BONDING IS NECESSARY
(외면에 페인팅이 안되는 파이프에는 접지용 와셔를 설치할 필요가 없음)

	STANDARD NAME	DSE - P5393S
DSME	REDUCING PIECE FOR O.C.I.M.F MANIFOLD	Enactment Date 1989.09.30.
		Revision Date 2005.02.15. (R3)

- VAPOR PRINCIPAL



NOTE

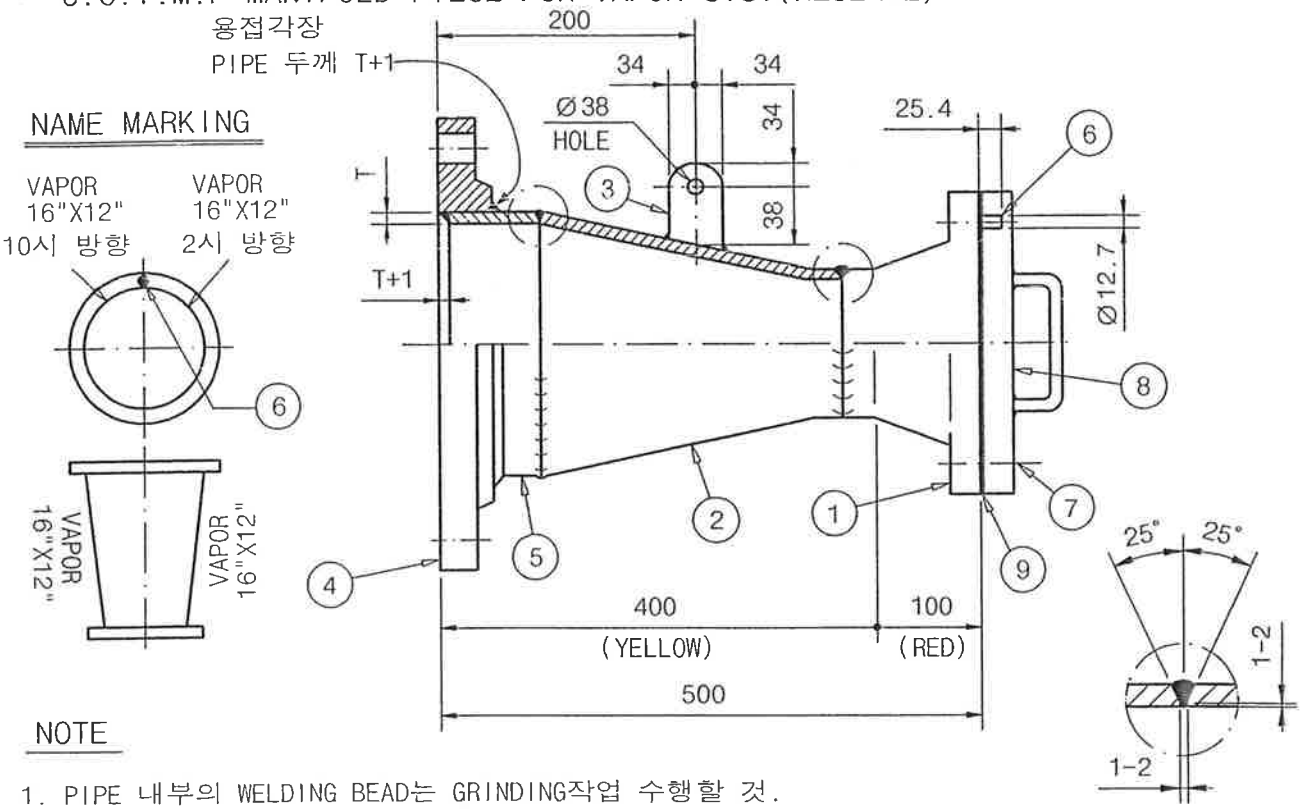
1. PIPE 내부의 WELDING BEAD는 GRINDING작업 수행할 것.
2. SIZE MARKING은 PIPE의 10시 방향과 2시 방향에 WELDING BEAD로 표기 하고 FINAL PAINT후 글자는 검은색으로 PAINT할 것.(글자 크기는 높이를 50mm로 할 것.)
3. 제작 수량 : ST/SHIP
4. 6번의 원통 STUD는 12시 방향에 설치되어야하며 THREAD TYPE으로 체결할 것.
5. BLIND FLANGE는 DSE-P5325S를 참조하여 제작하고 BOLTS, NUTS & GASKET을 완전히 체결하여 입고할 것.
6. FINAL PAINT COLOUR는 도면에 준하여 구분 PAINTING할 것.
7. PAINT CODE : IN SIDE =____ OUT SIDE =____

VAPOR PRIN-CIPAL	600X400A(24"X16")	CON BW 600X400A	JIS 5K-600A	ERW PE 12.7T 600A	373
	500X400A(20"X16")	CON BW 500X400A	JIS 5K-500A	ERW PE 12.7T 500A	350
TYPE	FLANGE SIZE(S)	(2) REDUCER	(4) SLIP-ON FLANGE	(5) PIPE	TOTAL WEIGHT(Kg)/EA

NO.	DESCRIPTION	SIZE	BOLTING HOLE SIZE	MATERIAL	Q'TY	REMARK
9	GASKET	ANSI 150PSI B16.21 3.2T(FF TYPE)	Ø30	NON-ASB	1	
8	FLG BLIND FLAT FACE	ANSI 150PSI B16.5	Ø30	A105	1	DSE-P5325S
7	HEX. BOLT AND NUT	M27x105L		S45C	16	
6	CYLINDRICAL STUD			S45C	1	Ø12.7MM x L25.4MM
5	PIPE	ERW PE 12.7T 500A		STPG370	1	
4	FLG SLIP-ON	JIS 5K-500A		SS400	1	
3	LIFTING LUG			SS400	1	
2	PIPE & REDUCER	CON BW 500X400A		STPG370	1	
1	FLG WELDING NECK FLAT FACE	ANSI 150PSI B16.5	Ø30	A105	1	

	STANDARD NAME	DSE - P5393S
DSME	REDUCING PIECE FOR O.C.I.M.F MANIFOLD	Enactment Date 1989.09.30.
		Revision Date 2005.02.15. (R3)

- O.C.I.M.F MANIFOLD PIECE FOR VAPOR SYS.(RESERVE)



NOTE

1. PIPE 내부의 WELDING BEAD는 GRINDING작업 수행할 것.
2. SIZE MARKING은 PIPE의 10시 방향과 2시 방향에 WELDING BEAD로 표기 하고 FINAL PAINT후 글자는 검은색으로 PAINT할 것.(글자 크기는 높이를 50mm로 할 것.)
3. 제작 수량 : ST/SHIP
4. 6번의 원통 STUD는 12시 방향에 설치되어야하며 THREAD TYPE으로 체결할 것.
5. BLIND FLANGE는 DSE-P5325S를 참조하여 제작하고 BOLTS, NUTS & GASKET을 완전히 체결하여 입고할 것.
6. FINAL PAINT COLOUR는 도면에 준하여 구분 PAINTING할 것.
7. PAINT CODE : IN SIDE =___ OUT SIDE =___

FLG X FLG SIZE	① FLANGE WELD 'G NECK	REDUCER	④ FLANGE SLIP-ON	PIPE	HEX. BOLT AND NUT	BOLTING HOLE SIZE	FLANGE BLIND	GASKET	WEIGHT Kg/EA
600X300A (24"X12")	ANSI 150PSI B16.5 12"	CON BW 600X300A	JIS 5K-600A	ERW PE 12.7T 600A	M24X90L	Ø27	ANSI 150PSI B16.5 12"	ANSI 150PSI B16.21 3.2T(FF TYPE)	302
500X300A (20"X12")	ANSI 150PSI B16.5 12"	CON BW 500X300A	JIS 5K-500A	ERW PE 12.7T 500A	M24X90L	Ø27	ANSI 150PSI B16.5 12"	ANSI 150PSI B16.21 3.2T(FF TYPE)	254
400X300A (16"X12")	ANSI 150PSI B16.5 12"	CON BW 400X300A	JIS 5K-400A	ERW PE 12.7T 400A	M24X90L	Ø27	ANSI 150PSI B16.5 12"	ANSI 150PSI B16.21 3.2T(FF TYPE)	188

NO.	DESCRIPTION	MATERIAL	Q'TY	REMARK
9	GASKET FF TYPE ANSI 150PSI B16.21 12" 3.2T	NON-ASB.	1	
8	FLG BLIND ANSI 150PSI FLAT FACE B16.5 12"	SS400	1	DSE-P5325S
7	HEX. BOLT AND NUT M22X90L	S45C	12	GALV.
6	CYLINDRICAL STUD	S45C	1	Ø12.7MM x L25.4MM
5	PIPE ERW PE 12.7T	STPG370 12.7T	1	
4	FLG SLIP-ON JIS 5K	SS400	1	
3	LIFTING LUG	SS400 : 15T	1	
2	REDUCER CON BW 12.7T	PG370	1	
1	FLG WELDING NECK ANSI FLAT FACE 150PSI B16.5	A105	1	

Chapter 13.10 Marpol Annex VI, Regulation 15 - Volatile organic compounds

(1) If the emissions of volatile organic compounds (VOCs) from tankers are to be regulated in ports or terminals under the jurisdiction of a Party to the Protocol of 1997, they shall be regulated in accordance with the provisions of this regulation.

(2) A Party to the Protocol of 1997 which designates ports or terminals under its jurisdiction in which VOCs emissions are to be regulated shall submit a notification to the Organization. This notification shall include information on the size of tankers to be controlled, on cargoes requiring vapour emission control systems, and the effective date of such control. The notification shall be submitted at least six months before the effective date.

(3) The Government of each Party to the Protocol of 1997 which designates ports or terminals at which VOCs emissions from tankers are to be regulated shall ensure that vapour emission control systems, approved by that Government taking into account the safety standards developed by the Organization,* are provided in ports and terminals designated, and are operated safely and in a manner so as to avoid undue delay to the ship.

(4) The Organization shall circulate a list of the ports and terminals designated by the Parties to the Protocol of 1997 to other Parties to the Protocol of 1997 and Member States of the Organization for their information.

(5) All tankers which are subject to vapour emission control in accordance with the provisions of paragraph (2) of this regulation shall be provided with a vapour collection system approved by the Administration taking into account the safety standards developed by the Organization, and shall use such system during the loading of such cargoes. Terminals which have installed vapour emission control systems in accordance with this regulation may accept existing tankers which are not fitted with vapour collection systems for a period of three years after the effective date identified in paragraph (2).

(6) This regulation shall only apply to gas carriers when the type of loading and containment systems allow safe retention of non-methane VOCs on board, or their safe return ashore.

ANNEX 10

RESOLUTION MEPC.185(59)
Adopted on 17 July 2009

GUIDELINES FOR THE DEVELOPMENT OF A VOC MANAGEMENT PLAN

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Marine Environment Protection Committee conferred upon it by international conventions for the prevention and control of marine pollution,

NOTING that the revised MARPOL Annex VI was adopted by resolution MEPC.176(58) which is expected to enter into force on 1 July 2010,

NOTING ALSO that regulation 15.6 of the revised Annex VI requires a tanker carrying crude oil to have onboard and implement a VOC management plan approved by the Administration, and that such a plan shall be prepared taking into account the guidelines developed by the Organization,

HAVING CONSIDERED the draft Guidelines for the development of a VOC management plan prepared by the Sub-Committee on Bulk Liquids and Gases at its thirteenth session,

1. ADOPTS the Guidelines for the development of a VOC management plan, as set out in the Annex to this resolution; and

2. INVITES Governments to apply the Guidelines from 1 July 2010.

ANNEX

GUIDELINES FOR THE DEVELOPMENT OF A VOC MANAGEMENT PLAN

1 Objectives

.1 The purpose of the VOC management plan is to ensure that the operation of a tanker, to which regulation 15 of MARPOL Annex VI applies, prevents or minimizes VOC emissions to the extent possible.

.2 Emissions of VOCs can be prevented or minimized by:

.1 optimizing operational procedures to minimize the release of VOC emissions; and/or

.2 using devices, equipment, or design changes to prevent or minimize VOC emissions.

.3 To comply with this plan, the loading and carriage of cargoes which generate VOC emissions should be evaluated and procedures written to ensure that the operations of a ship follow best management practices for preventing or minimizing VOC emissions to the extent possible. If devices, equipment, or design changes are implemented to prevent or minimize VOC emissions, they shall also be incorporated and described in the VOC management plan as appropriate.

.4 While maintaining the safety of the ship, the VOC management plan should encourage and, as appropriate, set forth the following best management practices:

.1 the loading procedures should take into account potential gas releases due to low pressure and, where possible, the routing of oil from crude oil manifolds into the tanks should be done so as to avoid or minimize excessive throttling and high flow velocity in pipes;

.2 the ship should define a target operating pressure for the cargo tanks. This pressure should be as high as safely possible and the ship should aim to maintain tanks at this level during the loading and carriage of relevant cargo;

.3 when venting to reduce tank pressure is required, the decrease in the pressure in the tanks should be as small as possible to maintain the tank pressure as high as possible;

.4 the amount of inert gas added should be minimized. Increasing tank pressure by adding inert gas does not prevent VOC release but it may increase venting and therefore increased VOC emissions; and

.5 when crude oil washing is considered, its effect on VOC emissions should be taken into account. VOC emissions can be reduced by shortening the duration of the washing or by using a closed cycle crude oil washing programme.

2 Additional considerations

.1 A person in charge of carrying out the plan

.1 A person shall be designated in the VOC management plan to be responsible for implementing the plan and that person may assign appropriate personnel to carry out the relevant tasks;

.2 Procedures for preventing or minimizing VOC emissions

.1 Ship-specific procedures should be written or modified to address relevant VOC emissions, such as the following operations:

.1 Loading;

.2 Carriage of relevant cargo; and

.3 Crude oil washing;

.2 If the ship is equipped with VOC reduction devices or equipment, the use of these devices or equipment should be incorporated into the above procedures as appropriate.

.3 Training

.1 The plan should describe the training programmes to facilitate best management practices for the ship to prevent or minimize VOC emissions.

***

The following references are to be referred when using this manual:

14.1 Operation and Equipment Manual for Vapour Emission Control System [Drawing No. DA800D113]

14.2 Operation and Equipment Manual for Vapour Emission Control System [Drawing No. DA800D111]

14.3 Flue Inert Gas System Manual [OSP No. IG110101B6C8-OHJW0S]