VAPOR EMISSION CONTROL SYSTEM MANUAL

(USCG VCS 46 CFR 39)

SHIP NAME : M/T DIAMOND-T

26.000 DWT CHEMICAL/OIL TANKER

OWNER :GALATA DENIZCILIK TICA.Ş.		**BUILDER : TURKER SHIPYARD**	
CLASS : G.L	**CLASS ID: 113853**	**HULL NO : NB17**	
		TITLE : VAPOUR EMISSION CONTROL SYSTEM MANUAL	
		IMO NO : 9499371	
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		PREP. BY : ENDER KESKİN	

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PART 1. MAIN PARTICULARS OF THE VESSEL

Vessel Name	:	**M/T DIAMOND-T**
Vessel Type	:	Oil / Chemical Tanker (IMO II)
LOA	:	**169,9 m**
B	:	**25,40 m**
Deadweight at design draft		**26.000**
Gross T	:	**17.712**
Net T	:	**8.551**
Owner	:	**GALATA DENIZCILIK TIC A.S.**
IMO No	:	**9499371**
Registration Number	:	**GL113853**
Flag	:	**PANAMA**
Port of Regisrty	:	**PANAMA**
Call Sign	:	
MMSI No	:	
Class	:	**GL**
Class Notation	:	100 A5 E3 ,CSR, Oil Tanker with Double Hull / Chemical Tanker Type II –ESP,Unrestricted Navigation ,AUT-UMS Enviromental Passport ,IW,VEC,BWM,MC,E3,AUT, Mon- Shaft, IG
Built Date	:	**2011**

PART 2. GENERAL

SECTION 1. DEFINITIONS

Cargo deck area means that part of the weather deck that is directly over the cargo tanks.Existing vapour collection system means a vapour collection system which was operating prior to July 23, 1990.Facility vapour connection means the point in a facility's fixed vapour collection system where it connects with the vapour collection hose or the base of the vapour collection arm. Independent as applied to two systems means that one system will operate with a failure of any part of the other system except power sources and electrical feeder panels.Inerted means the oxygen content of the vapour space in a cargo tank is reduced to 8 percent by volume or less in accordance with the nitrogen requirements.Lightering or lightering operation means the transfer of a bulk liquid cargo from a tank vessel to a service vessel.Maximum allowable transfer rate means the maximum volumetric rate at which a vessel may receive cargo or ballast.New vapour collection system means a vapour collection system which is not an existing vapour collection system.Service vessel means a vessel which transports bulk liquid cargo between a facility and another vessel.Topping-off operation means the transfer of a bulk liquid cargo from a service vessel to another vessel in order to load the receiving vessel to a deeper draft.Vapour balancing means the transfer of vapour displaced by incoming cargo from the tank of a vessel receiving cargo into a tank of the vessel or facility delivering cargo via a vapour collection system.Vapour collection system means an arrangement of piping and hoses used to collect vapour emitted from a vessel's cargo tanks and to transport the vapour to a vapour processing unit.Vapour control system means an arrangement of piping and equipment used to control vapour emissions collected from a vessel. It includes the vapour collection system and vapour processing unit.Vapour processing unit means the components of a vapour control system that recovers,destroys, or disperses vapour collected from a vessel.Vessel vapour connection means the point in a vessel's fixed vapour collection systemwhere it connects with the vapour collection hose or arm.

SECTION 2. PERSONNEL TRAINING

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 include drills or demonstrations using the installed vapour control system covering normal operations and emergency procedures.The training program required by paragraph of this section must cover the following subjects:

(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 this part;
(6) Operating procedures, including:
(i) Testing and inspection requirements,
(ii) Pre-transfer procedures,
(iii) Connection sequence,
(iv) Start-up procedures, and
(v) Normal operations; and
(7) Emergency procedures.

SECTION 3. SUBMISSION THE VAPOUR CONTROL SYSTEM DESIGNS

The owners/operators of a foreign flag vessel may submit certification by the classification society which classes the vessel that the vessel meets the requirements of 46 CFR Part 39.Upon satisfactory completion of plan review and inspection of the vapour collection system or the receipt as the certification referred to the above paragraph, the Officer in charge,Marine Inspection shall endorse Certificate of Compliance for foreign flag vessels,

that the vessel is acceptable for collecting the vapour from crude oil, gasoline blends, and benzene, or any other vapour it is found acceptable to collect.

PART 3 DESIGN AND EQUIPMENT

SECTION 1. VAPOUR COLLECTION SYSTEM

The vessel's vapour collection system having the following particulars:
Two separate DN 200 stainless steel 316L the main vapour return line is installed.The main vapour return lines are connected to the DN200 vapour manifolds line which are located at aft&fore end of the cargo manifold.Air vent of cargo Tank 1-3-5-7(P&S)-Slop P are connected to first Vapour return line which have a manifold at the aft end of the cargo manifold and 2-4-6(P&S)-Slop S are connected to second Vapour return line which have a manifold at the fore part of the cargo manifold.Air vent pipes of the cargo tanks are connect to the VAPOUR return line with butterfly valve and spec. flange.Draining valves are provided to eliminate liquid condensate which may collect in the system and collecting liquid from each low point in the line.Vapour collection piping is electrically bonded to the hull and electrically continuous.Main vapour return line is connected to the each cargo / slop ventilation line by means of butterfly valve and spec. flange.The vapour collection system must not interfere with the proper operation of the cargo tank venting system. Also two DN200 detonation arresters are fitted on VAPOUR return lines before shore connection.Vapour collection lines is fitted with butterfly valve at both port and starboard side.The valves have an indicator to show clearly whether the valve is in the open or closed position, unless the valve position can be readily determined from the valve handle or valve stem.
The last 1.0 meter (3.3 feet) of vapour piping before the vessel vapour connection is:
(1) Painted red/yellow/red with:
(i) The red bands 0.1 meter (0.33 feet) wide, and
(ii) The middle yellow band 0.8 meter (2.64 feet) wide; and
(iii) The second red band after the yellow part 0.1 meters (0.33 feet) wide
(2) Labeled ``VAPOUR'' in black letters at least 50 millimeters (2 inches) high.
Each vessel vapour connection flange is a permanently attached 0.5inch(12,7mm)diameter stud at least 1.0(25,4mm) inch long projecting outward from the flange face. The stud is located at the top of the flange (12 o'clock) , midway between bolt holes, and in line with the bolt hole pattern.The vessel is not carry a hose onboard for vapour connection to facility.VAPOUR hose handling equipment is provided with hose support which provide adequate support to prevent kinking or collapse of hoses.Each cargo / slop tanks is fitted with stainless steel 316L ventilation pipe from tank's hatch leading to 3000 mm high from catwalk.The diameter of the cargo tanks 1,2,3,4,5,7 P/S ventilation pipe is DN 125, the diameter of the cargo tanks 6 P/S and slop tanks ventilation pipe is DN 100. And are all connected to the vapour return line systems of DN200.Each vent line is arranged self drained to permit their drains to the tanks all normal trim and list conditions.Each vent line kept as short as possible to reduce pressure drop in lines.The vent lines are adequately supported to the vessel separately.The stainless steel 316 high velocity pressure / vacuum valve is fitted end of the eachventilation lines.

SECTION 2. PRINCIPLE OF OPERATION OF PRESSURE / VACUUM VALVES

The high speed p/v valve operates automatically as breather valve and a discharge vent without any kind of manual interference.The valve functions as a double check valve. Gas displaced by an incoming volume of cargo forces a weighted pressure disc off its seat. The greater the incoming volume, the higher the pressure disc will lift. This is evidenced by the degree in which the valve tip protrudes above the housing. When tank pressure again drops to the present level, the disc will re-seat. The discharge velocity from the valve is almost constant regardless of the loading rate. The valve provides safe operation even when venting the low volumes associated with hazardous topping off operations. Typical discharge velocity is 30 m/sec,or three times the velocity of flame propagation. And since the pressure disc acts

like anair-break, venting is accomplished without fluttering.The high speed valves also function as a vacuum valve during unloading. In non-inerted gas systems, the vacuum valve portion opens, permitting atmospheric air to be drawn in to the emptying tank. If the tank is inerted, the inert gas generating system will maintain pressure as the volume of liquid cargo is drawn off. In this circumstancies the vacuum valve portion serves only as a class required safety device.
The set pressure of the pressure vacuum valves are :
Pressure side: + 21.0 kpa
Vacuum side : - 3.5 kpa
Vessel fitted with PRESSURE SENSORS (with alarms and monitoring in CCR) per tank in order to comply with SOLAS (CONSOLIDATED EDITION 2004) CHAP II-2 - REG 11 I 6.3.2 SECONDARY MEANS OF VENTING,
Radar alarms are set as below;
- Alarms at a high pressure is set 0.23 bar (2310 mmWG) which is 10 percent higher of the pressure relieve valve setting in the cargo tank venting system (when VECS not in use)
- Alarms at a low pressure is set 0.038 bar (385 mmWG) which is 10 percent higher of the vacuum relieve valve setting in the cargo tank venting system (when VECS not in use)

SECTION 3. CARGO GAUGING SYSTEM

Each cargo tank of a tank vessel that is connected to a vapour collection system is equipped with a radar type cargo gauging device.The Kongsberg make radar GL 300 is a stand alone parabollic radar type level transmitter using a frequency modulated continuous wave (FMCW), electromagnetic signal to measure distance between its antenna and cargo tank content surface (ullage).Levels of the tanks are indicated on the cargo control station.The difference frequency (dF) between emitted and reflected FMCW signals is proportional directly to ullage. A suitable data processor is able then to calculate accurate distance.The calculated ullage in millimeters is directly then sent to cargo control room system monitor.ue to its location in hazardous area on deck, the radar meets EC-Type Examination certificate NEMKO 09ATEX1132x and NEMKO 09ATEX1133 intrinsic Safety (IS) rules. The power supplies and digital link from each transmitter are protected by individual ‘safety block’ located in Cabinet GLK 300 safety module installed in cargo control room.The radar certified II 1 (1) G/D Eex ia (ia) IIC T4 according to NEMKO certificate of conformity Ex 09ATEX1132X .Additionally three closed type manual sounding devices are kept on board. VAPOUR locks for manual ullage, temperature, and interface device for closed.

SECTION 4. TANK LIQUID OVERFILL PROTECTION

Each cargo tank of a tank ship is equipped with an intrinsically safe high level alarm (Eex Ia IIc T6) and a tank overfill alarm. High level (95%) and high high level (98%) alarm,omıcron Type OAS5 Indication in the cargo control station with light and siren at top of the accommodation**.**The Kongsberg make alarm sensors detect high or overfill level in any liquid, with an alarm output given by current loop detection.This principle is based on the absorption of ‘mechanical’ waves at the tip of the probe.The alarm system provides a very safe operation, the circuitry includes a fail safe detection which activates an alarm for the following:
The intrinsic safe data of the alarm
PTB certificate N Ex-199/507172 for flashing light (Eex d IIC T6)
CESI certificate N Ex-95D-072 for isolated barriers (EEx ia) IIC.
The alarm test is achieved by approaching magnet on top of the housing. Alarm should be activated immediately.
The high level alarm is
Independent of cargo gauging system.
Independent from overfill alarm.

Alarm in the event of failure of electrical circuitry to the tank level sensor.
The high level alarm is set before the tank overfill alarm, at 95 percent of tank capacity.Identified in the cargo control room with the legend ``High Level Alarm'' in black letters at least 50 millimeters (2 inches) high on a white background.Have audible and visible yellow alarm indications that can be seen and heard on the vessel where cargo transfer is controlled.
The tank overfill alarm is;
Independent of the cargo gauging system.Independent from high level alarm.
Alarm in the event of failure of electrical circuitry to the tank level sensor.Alarm is set at 98 percent which is early enough to allow the person in charge of transfer operations to stop the transfer operation before the cargo tank overflows. For overfill calculation please refer in part 5 of this manual.Identified in the cargo control room with the legend ``TANK OVERFILL ALARM'' in black letters at least 50 millimeters (2 inches) high on a white background.Have audible and visible alarm indications that can be seen and heard on the vessel where cargo transfer is controlled and in the cargo deck area.

SECTION 5. VAPOUR OVERPRESSURE AND VACUUM PROTECTION

The cargo tank vapour and venting system
Pressure side:
is capable of discharging cargo vapour at 1.25 times the maximum cargo loading transfer rate such that the pressure in the vapour space of each tank connected to the vapour collection system does not exceed 24 kPa (2375 mmWG,) which is the maximum design working pressure for the tank.Anyway, vapour transfer rate must not exceed the 80 percent of PV valve maximum venting capacity.The PV valve on vent system not relieve at a pressure corresponding to a pressure in the cargo tank VAPOUR space of 21 kPa (2100 mmWG) which is the PV valve pressure side set pressure.The tank pressure in any tank must not exceed 16,8 kPa (80% x 0.21 is PV valve pressure side set pressure).Please note that vapour discharge rate depends on the vapour density.For detailed information see the pressure drop calculation in part 6 of this manual.
Vacuum side:
Vacuum in the cargo tank vapour space generated by discharging maximum cargo unloading rates, does not exceed 7 kPa (700 mmWG, 1 psig) which is the maximum design vacuum for any tank connected to the vapour collection system.The PV valve fitted on vent system relieve at a vacuum corresponding 3.5 kPA (350mmWG, 0.5 psig) below atmospheric pressure.
Each pressure-vacuum relief valve must:
-Be tested for venting capacity in accordance with paragraph 1.5.1.3 of API 2000; and
-Have a means to check that the device operates freely and does not remain in the open position,
-The relieving capacity test of must be carried out with a flame screen fitted at the vacuum relief opening.
Please note that vapour transfer rate depends on the vapour density.For detailed information see the pressure drop calculation in part 6 of this manual.

SECTION 6. HIGH AND LOW VAPOUR PRESSURE PROTECTION

Vapour collection system is equipped with a pressure sensing device that senses the pressure in the main vapour collection line.The Kongsber GT404/402 make pressure transmitter which is a 2 wires 4-20 mA, fully welded and it is submersible (IP67), housed in stainless steel AISI 316L using a capacitive ceramic diaphragm is fitted on the vapour collection line.
Intrinsic safety data of the transmitter Eex ia IIC T5
The sensor;
-Has a pressure indicator located on the vessel where in cargo control station. The cargo transfer is controlled; and
-Has a high pressure and a low pressure alarm that is audible and visible on the vessel

where in cargo control room, the cargo transfer is controlled;
- Alarms at a high pressure is set 0.23 bar (2310 mmWG) which is 10 percent higher of the pressure relieve valve setting in the cargo tank venting system (when VEC system not in use)
- Alarms at a high pressure is set 0.17 bar (1680 mmWG) which is 20 percent lower of the pressure relieve valve setting in the cargo tank venting system (when VEC system is in use)
- Alarms at a low pressure is set 0.038 bar (385 mmWG) which is 10 percent higher of the vacuum relieve valve setting in the cargo tank venting system (when VEC system not in use
- Alarms at a low pressure is set 0.028 bar (280 mmWG) which is 20 percent lower of the vacuum relieve valve setting in the cargo tank venting system(when VEC system is in use)

SECTION 7. OPERATIONAL REQUIREMENTS

Vapour from a tank vessel may not be transferred to:
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.The pressure drop through the vapour collection system from the most remote cargo tanks to the vessel vapour connection included in part 6 of this manual is based on following conditions:
-Determined for each cargo handled by the vapour collection system at the maximum transfer rate and at lessor transfer rates;
-Based on a 50 percent cargo vapour and air mixture, and a vapour growth rate appropriate for the cargo being loaded; and
-Included in the vessel's oil transfer procedures as a table or graph showing the liquid transfer rate versus the pressure drop.
The vessel does not carry vapour hose for shore connection.The rate of cargo transfer must not exceed the maximum allowable transfer rate as determined by the lesser of the following:
Capacity which is 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.Capacity which is the total vacuum relieving capacity of the vacuum relief valves in the cargo tank venting system when relieving at the set pressure.

A cargo tank must not be filled higher than:
-98 percent of the cargo tank volume; and
-The level at which an overfill alarm complying with part 33 of this manual.

A cargo tank must not be opened to the atmosphere during cargo transfer Operations except as provided in paragraph below.The isolation valve of the nitrogen system at the connection of vapour collecting system shall remain closed during vapour transfer.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:
-The cargo tank is not being filled.
-Except when the tank is inerted, any pressure in the cargo tank vapour space is first reduced to atmospheric pressure by the vapour control system;
-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 USCG VCS; and

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, remains bonded to the vessel until it is removed from the tank, and if the tank is not inerted, a period of 30 minutes has elapsed since loading of the tank was completed.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.
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.Alarm at a low pressure of not less than 1 kPa (100mmWG) for an inerted tank is to be provided. At the lowest vacuum relief valve setting in the cargo venting system for a non-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.
The vessel has N2 Generator System on board.

PART 4 CARGO OIL TRANSFER PROCEDURES WITH VAPOUR CONTROL SYSTEMS

SECTION 1 CARGO LOADING WITH VAPOUR DISCHARGING

If required by the nature of cargo or by the shore terminal, the VAPOUR is to be returned ashore during loading.
Procedure:
Ensure that all cargo tank hatches are closed.Spec. flanges to be removed and butterfly valves are to opened and fitted between vapour manifold line and cargo tank vent line.A hose connection is to be arranged from shore tank to the cargo tank manifold.Second hose connection to be arranged from vapour manifold line to the shore vapour facility.Commence loading the cargo tank with cargo.While loading the cargo, the tank atmosphere leaves the tank via the vapour main, vapour manifold to the shore facility.The tank venting and vapour system is capable of discharging cargo vapour at 1.25 times the maximum transfer rate such that the pressure in the vapour space of each tank connected to the vapour collection system does not exceed the 24 kPa which is maximum design working pressure for the tank. (CFR 39.20-11 (a)-(1)).Anyway, vapour transfer rate must not exceed the 80 percent of PV valve maximum venting capacity. (CFR 39.30-1-(d)-(1)).The PV valve on vent system relieve at a pressure corresponding to a pressure in the cargo tank vapour space of 20kPa which is the PV valve pressure side set pressure. (CFR39.20-11(4))
The tank pressure in any tank must not exceed 16,8 kPa (80% x 21 which is PV valve pressure side set pressure) (CFR 39.30-1-(d)-(3)).Please note that vapour discharge rate depends on the vapour density.For detailed information see the pressure drop calculation in part 6 of this manual.End of the loading the nitrogen is displaced and the hydrocarbon gas content of the tank atmosphere is increased as a result of the gas emanation from the cargo.

SECTION 2 CARGO UNLOADING WITH VAPOUR COLLECTING

If required by the nature of cargo or by the shore terminal the VAPOUR is to be returned to cargo tanks during unloading.
Procedure :
Ensure that all cargo tank hatches are closed.Spec. flanges to be removed and butterfly valves are to opened and fitted from respective tank venting pipe to the vapour return main pipe.A hose connection is to be arranged from shore tank to the cargo tank manifold.Second hose connection to be arranged from vapour manifold line to the shore vapour facility.Commence unloading the cargo tank with cargo.The tank atmosphere is being filled with vapour while emptying the cargo.The vacuum in the cargo tank vapour space, generated by discharging maximum cargo unloading rates, does not exceed 7 kPa (700 mmWG) which is the maximum design vacuum for any tank connected to the vapour collection system. (CFR 46.39.30-1 (d)(2)).The PV valve on vent system relieve at a vacuum corresponding to 3.5 kPa (350 mmWG,0.5 psig) below atmospheric pressure. (CFR 39.20-11(4))

SECTION 3 PRECAUTIONS DURING CARGO OPERATIONS

3.1 CARGO SYSTEMS

3.1.1.Cargo tank venting

Liquid should not be permitted to enter the VAPOUR return line. If liquid gets into the VAPOUR line it will cause the cross section available for the flow of VAPOUR to be reduced, as a result of which the pressure inside the tank can rise rapidly. Loading should be suspended until the pressure is released, and the presence of liquid dealt with.

3.1.2.Preparing a cargo tank atmosphere

3.1.2.1.Receiving nitrogen from shore

The pressure and the flow rate of incoming nitrogen must therefore be controlled. Use of a small hose or a reducer prior to the manifold will restrict the flow rate, but pressure must be controlled by the shore. A gauge will allow the ship to monitor the pressure. It is not appropriate to attempt throttling a gas flow by using the ship's manifold valve that is designed to control liquid flow. However, the manifold valve can and should be used as a rapid safety stop in an emergency: pressure surge in a gas is not as violent as in a liquid.When shore supplied nitrogen is to be used for drying or purging an empty tank that has been cleaned and gas freed, the volume of nitrogen required should be calculated and agreed (tank volume multiplied by number of atmosphere changes needed to reach the desired level of dryness or oxygen exclusion), together with the flow rate, during the pretransfer planning conference.Table 1 show the volume of nitrogen that can be received in one minute through a known size of pipe at a known pressure.(The second figure in brackets indicates the associated hourly rate which should be mentally compared to a liquid loading rate.Note that these tables are intended to be indicative only, and any discrepancies are due to rounding of figures.)

	200mm (8")	150mm(6")	100mm(4")	50mm(2")	25mm(1")
5.2 bar (75 psi)	**1,771(106,000)**	**914(55,000)**	**343(20,600)**	**67(4,000)**	**12(270)**
3.4 bar (50 psi)	**1,286(77,000)**	**662(39,700)**	**243(14,600)**	**48(2,900)**	**9(530)**
2.1 bar (30 psi)	**886(53,000)**	**457(27,375)**	**171(10,300)**	**33(2,000)**	**3(360)**
0.7 bar (10 psi)	**471(28,300)**	**214(12,900)**	**80(4,800)**	**16 (1,000)**	**3(170)**

Table 1 Cubic meters of gas at various gauge pressures received in 1 minute (and 1 hour) through hoses of various sizes.

Table 2 illustrates the time taken to receive gas into a tank at different pressure and hose sizes. The example used assumes a cargo tank of 1,250 cubic meters requiring four atmosphere changes, i.e. 5,000 cubic meters of nitrogen, to flow through.

	200mm	150 mm	100 mm	50 mm	25 mm
5.2 bar	**3 min.**	**5 ½ min.**	**15 min.**	**1 ¼hrs.**	**7 hrs.**
3.4 bar	**4 min.**	**7 ½ min.**	**21 min.**	**1 ¾ hrs.**	**10 ½ hrs.**
2.1 bar	**5 ½ min.**	**11 min.**	**29 min.**	**2 ½ hrs.**	
0.7 bar	**11 min.**	**24 min.**	**63 min.**	**5 ¼ hrs.**	

Table 2 Time to receive 5,000 cubic meters of gas with various gauge pressures and hose sizes.

When a cargo is required to be carried under a pad of nitrogen, and it is necessary to use nitrogen supplied from shore, it is better to purge the entire tank before loading. After such purging is completed, loading the cargo in a closed condition will create the needed pad within the tank. The risk of over pressurization can be substantially reduced by avoiding padding with shore supplied nitrogen as a separate procedure on completion of loading.However, if padding with shore nitrogen has to be performed after loading, planning andgood communication is essential. The supply should be through a small diameter connection to restrict the flow, and the rate must not exceed the vent capacity of the cargo tank. The operation should be stopped when a slight overpressure exits in the ullage space, but which is less than the tank pressure relief valve setting. The VAPOUR space in a loaded tank is usually small, so over pressurization can occur very suddenly, especially if cargo is forced into the vent lines which then become restricted or blocked and add to the rapid increase in tank pressure.

3.1.2.2.Preparations for receiving nitrogen from shore

● Care should be taken to ensure that the valves on the loading line between the shore manifold and the ship's tank are operated in the correct sequence, so that the ship is in control of the nitrogen flow. The ship should station a crew member at the loading manifold valve during the operation, even where remotely operated valves can be closed more quickly by a person in the cargo control room who is monitoring tank pressures. The crew member at the manifold is in the best position to react promptly to any other external indication of trouble.

● In general, nitrogen should not be delivered to the ship this way, and the ship should request that it is provided from gas held in a buffer tank. If a ship suspects that traces of liquid nitrogen are arriving at the manifold valve (possibly indicated by ice forming on the ship's lines and valves), or that other agreed procedures are not being followed the operation should be suspended until the apparent problems have been satisfactorily resolved.

3.1.3. CARGO LOADING

3.1.3.1. Use of compressed gas

Compressed gas is sometimes used by a terminal to press products out of shore tanks (such as railway wagons) into the ship, and there is an inherent risk of over pressurization of the ship's cargo tank. The gas pressure used for these operations varies, but can range between 250 and 500 kPa. The point of greatest concern is when the supply into the ship's tank changes from liquid to compressed gas, causing an abrupt and dramatic increase in the tank filling rate from liquid at a few hundred cubic meters per hour to gas at several thousand cubic meters per hour. It will be seen from Table 5.1 that a significant volume of gas will be received in a few seconds through the large liquid filling line. Over pressurization of a closed tank can occur in seconds, especially when the distance fro the manifold to the tank is small or the VAPOUR space in the tank is limited. A crew member stationed at the manifold will be best placed to detect and react to any indication that the flow in the system has changed from liquid to gas.

3.1.3.2. Topping off

Care must be taken as tanks become full, especially when loading a product into more than one tank simultaneously, due to the increased risk of an overflow while topping off. High level alarms and tank overflow control alarms are safety critical items, and loafing should be stopped if it is suspected that either is not working correctly.The responsible officer must ensure that tanks that have been topped off are properly isolated from tanks still being loaded. Cargo tanks which have been topped off should be checked frequently during the remaining loading operations to detect changes in liquid level, and to avoid an overflow.When nearing completion of loading the shore should be notified and, if necessary, theloading rate reduced.

3.1.3.3. Clearing shore pipelines

When, after completion of a product, the shore pipelines are to be cleared by the use of air or nitrogen (blow through) or by use of a line scraper (pigging), the responsible officer must ensure that there is sufficient space in the tank or tanks to accommodate the quantity of

product in the shore pipeline, otherwise cargo overflow from a tank may occur.Blowing through or pigging could cause an increase in pressure, and the responsible officer must monitor the operation carefully in order to avoid tank over pressurization. The risk of large volumes of nitrogen or air that has been under pressure in the shore line, escaping into the cargo tank must be take into account. The same possibility exits for an abrupt and dramatic increase in the tank when pressing a chemical out of shore tanks. During a line clearing operation it is important that terminal staff react promptly when the scraper is caught in its trap, in order to avoid all the compressed propelling gas entering a loaded cargo tank.

3.1.4. CARGO UNLOADING

3.1.4.1. Adding nitrogen to maintain overpressure

When unloading cargoes that have to be carried under a blanket of nitrogen, it may be necessary to ensure that no air is drawn into the tank. Therefore an overpressure of nitrogen should be maintained as the liquid level falls. The nitrogen can be supplied from stored compressed gas or from nitrogen generator on board, and be introduced into tank ullage space.But if it is necessary to obtain nitrogen from the shore, it is essential that the pre-transfer discussion includes agreement on the nitrogen flow rate and pressure to be used. Although the overpressure required is no more than about 20 kPa, it is usual for the shore nitrogen supply system to be well above this figure, perhaps as high as 700 kPa. Particularly in the early stages when the ullage space is still small, it is possible for the flow rate to exceed the tank venting capacity, and for an overpressure to develop. A safe procedure is to use a pressure reducing device on the nitrogen supply line, and to have a calibrated gauge showing the pressure in the pipeline. There should be direct communication with the terminal, and the ship should monitor cargo tank ullage space pressure throughout.

3.2. ENVIROMENTAL CONTROL OF VAPOUR SPACE IN CARGO TANK

3.2.1. APPLICATION TO CARGO TANK OPERATIONS

3.2.1.1.Discharge of cargo or ballast from inerted tanks

If the supply of nitrogen fails during unloading, the positive pressure in the tanks will rapidly be lost. Unloading should be stopped immediately to prevent ingress of air, and should not be resumed until the nitrogen supply is restored.If the pipe is broken down during the operation, the loading or unloading should be stopped immediately and situation should be informed to the shore.

PART 5 OVERFILL ALARM CALCULATION

Loading rate calculation is made in accordance to IBC code 15.19.8

Ship Loading conditions:

Cargo tanks 1P/S, 2P/S, 3P/S, 4P/S, 5P/S, 7P/S of the vessel design loading rate is maximum 380 m3/h which corresponds to suitable velocities in the cargo pipes.Cargo tanks 6 P/S and Slop P/S of the vessel design loading rate is maximum 200m3/h which corresponds to suitable velocities in the cargo pipes.Each cargo tank has hydraulic operated butterfly valves for loading. These valves are remote operable type from cargo control station.Each cargo tank has %95 high level and %98 overfill alarms which are visible and audible from cargo control room and cargo area separately (visible different color, audible different sound).Means of communications between the cargo control station and cargo shore connection location are provided (safety type telephone apparatus etc).When the %95 level alarm is taken the loading rate will be reduced and responsible ship crew and shore will wait on stand by.All these loading conditions when the %95 alarm is taken the duration (T) to contact shore to stop loading and closing manifold valve is given below for each tank.The minimum safety duration (T) is assumed 60 sn (Important note: The cargo system test pressure 1600 kPa)

LR = Loading rate (m3/h)
V = Difference between %98 and %100 ullage volume (m3)
T = Loading stop duration (sec)
LR = (3600 * V) / T

TANK NAME	%100 CAPACITY	V(m3)%2	LR(m3/h)	T(sec)
SLOP TANK S	313.921	6.27842	300	75
SLOP TANK P	316.114	6.32228	300	76
CARGO TANK 1S	1978.413	39.56826	450	317
CARGO TANK 1P	1978.18	39.5636	450	317
CARGO TANK 2S	2276.036	45.52072	450	364
CARGO TANK 2P	2272.493	45.44986	450	364
CARGO TANK 3S	2427.666	48.55332	450	388
CARGO TANK 3P	2423.732	48.47464	450	388
CARGO TANK 4S	2428.62	48.5724	450	389
CARGO TANK 4P	2424.686	48.49372	450	388
CARGO TANK 5S	2428.594	48.57188	450	389
CARGO TANK 5P	2424.659	48.49318	450	388
CARGO TANK 6S	1197.426	23.94852	300	287
CARGO TANK 6P	1193.491	23.86982	300	286
CARGO TANK 7S	2465.177	49.30354	450	394
CARGO TANK 7P	2465.177	49.30354	450	394

ADDENDUM 1 PRESSURE DROP CALCULATIONS
Please refer enclosed files.

ADDENDUM 2 CARGO TANK VENTILATION SYSTEM
Please refer enclosed drawing.

ADDENDUM 3 DECK ARRANGEMENT
Please refer enclosed drawing.

ADDENDUM 4 COMPATIBILITY OF CARGOES
Please refer enclosed drawing

ADDENDUM 5 GAS DENSITY OF CARGOES
Please refer enclosed drawing

BAY Valves ApS | Bay@bayvalves.com | Tel.: +45 7022 1892 | Fax.: +45 7014 1892

BAY VALVES

Cargo tank Safety valves & Flame protection equipment

PRESSURE DROP CALCULATION NO:	**10282**

Project:	NB 17/ MT DIAMOND T IMO NO: 9499371
IMO type:	IMO II/ OIL CHEMICAL
Size:	26.000 DWT
Shipyard:	TURKER
Owner:	GALATA SHIPPING CO.
Consultant:	-
Agent:	GEPA

Pressure drop calculation -

1. **Applicable to IMO IBC CODE**
2. **Applicable to USCG 46 C.F.R. PART 39—VAPOR CONTROL SYSTEMS**

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Rules & Regulations

1.1 System Design.

- ✓ SOLAS 74 chapter II-2 REG 59
  Venting, purging, gas-freeing and ventilation.

- ✓ IMO MSC/CIRC 731
  Revised factors to be taken into consideration when designing cargo tank venting and gas-freeing arrangements.

- ✓ USCG CFR 46 part 39 –Vapour control system.

  ADNR 2003
  Transport of Hazardous Material / Dangerous Goods on the river Rhein.

- ✓ ISO 15364:2000
  Ships and marine technology – Pressure/vacuum valves for cargo tanks.

1.2 Test Standards

- ✓ IMO MSC/CIRC 677
  Revised standards for the design, testing and locating of Devices to prevent the Passage of Flames into cargo tanks in tankers.

- ✓ IMO MSC/CIRC 1009
  Amendments to the revised standards for the design, testing and locating of Devices to prevent the Passage of Flames into cargo tanks in tankers.

- ✓ CEN European Standard EN 12874
  Flame arresters – Performance requirements, test methods and limits for use.

System design

Pressure-vacuum valve venting system

The system in question has been either informed or estimated as having the following characteristic:

	INFORMED	ESTIMATE		INFORMED	ESTIMATE
IMO Designation		IMO II	Cargo tanks	17	
Cargo Gas-group	IIA		Slop tanks		
MESG	0,9		Residual tanks		
USCG VCS	YES		Gas-freeing covers	17	
Common	NO		Gas freeing blower	IGS	
Individual	YES		Setting – pressure	2100 mm wg	
Tank pressure	Controlled		Setting Vacuum	350 mm wg	
Cargo Segregation	ALL		Material	AISI 316	
Loading rate	380 m^3/h		Flange	ISO DIN PN 10	
Un-loading rate	380 m^3/h		Packings	viton	

Description of the piping system from the worst-case scenario tank to the P-V valve.
The following figures have been used throughout for pressure drop calculations.

Resistence factors	ζ	Quantity	Σ
Inlet	0,50	1	0,5
Outlet	1,00	0	0
Bends (degrees)			
10	0,04		0
15	0,07		0
30	0,13		0
45	0,18	1	0,18
50	0,19		0
60	0,22		0
70	0,24		0
90	0,25	2	0,5
Reduction	0,04		0
Expansion	0,50		0
T-pipe, straight flow	0,10	1	0,1
Σζ			1,28
Internal pipe diameter		125	mm
Lenght of pipe		42	m

Vapour return system

Below scheme has formed basis for the pressure drop calculations and establishing the maximum loading rates when using the vapour return system for venting.
If the scheme is not correct, or there have been some changes, please fill in the bottom scheme and return it to our office.

Pipe section		**Pipe CT 7 SB**		**VECS 1**		**VECS 2**		**VECS 3**		**Vecs5**		**Vecs6**	
Pipe size		mm	125	mm	250	mm	250	mm		mm		mm	
Pipe length		m	42	m	1,2	m	25,6	m		m		m	
Restrictions:	Zeta	Qty.	Zeta	Qty.	Zeta	Qty.	Zeta	Qty.	Zeta	Qty.	Zeta	Qty.	Zeta
Inlet	0,50	1	0,5	0	0	0	0	0	0	0	0	0	0
Outlet	1,00	0	0	0	0	0	0	0	0	0	0	0	0
Butterfly valve	0,20	0	0	0	0	0	0	0	0	0	0	0	0
Gate valve	0,25	0	0	0	0	0	0	0	0	0	0	0	0
45° bend	0,18	3	0,54	0	0	2	0,36	0	0	0	0	0	0
90° bend	0,25	1	0,25	1	0,25	2	0,5	0	0	0	0	0	0
Angle flow in T-pipe	1,52	0	0	0	0	0	0	0	0	0	0	0	0
Angle flow in T-pipe	1,35	0	0	0	0	0	0	0	0	0	0	0	0
Straight flow in T-pipe	0,10	0	0	0	0	0	0	0	0	0	0	0	0
Confluence in T-pipe	3,00	1	3	1	3	1	3	0	0	0	0	0	0
Confluence in T-pipe	0,80	0	0	0	0	0	0	0	0	0	0	0	0
Reducer	0,20	0	0	0	0	0	0	0	0	0	0	0	0
Expansion	0,50	0	0	0	0	0	0	0	0	0	0	0	0
Total Zeta value			4,29		3,25		3,86		0		0		0

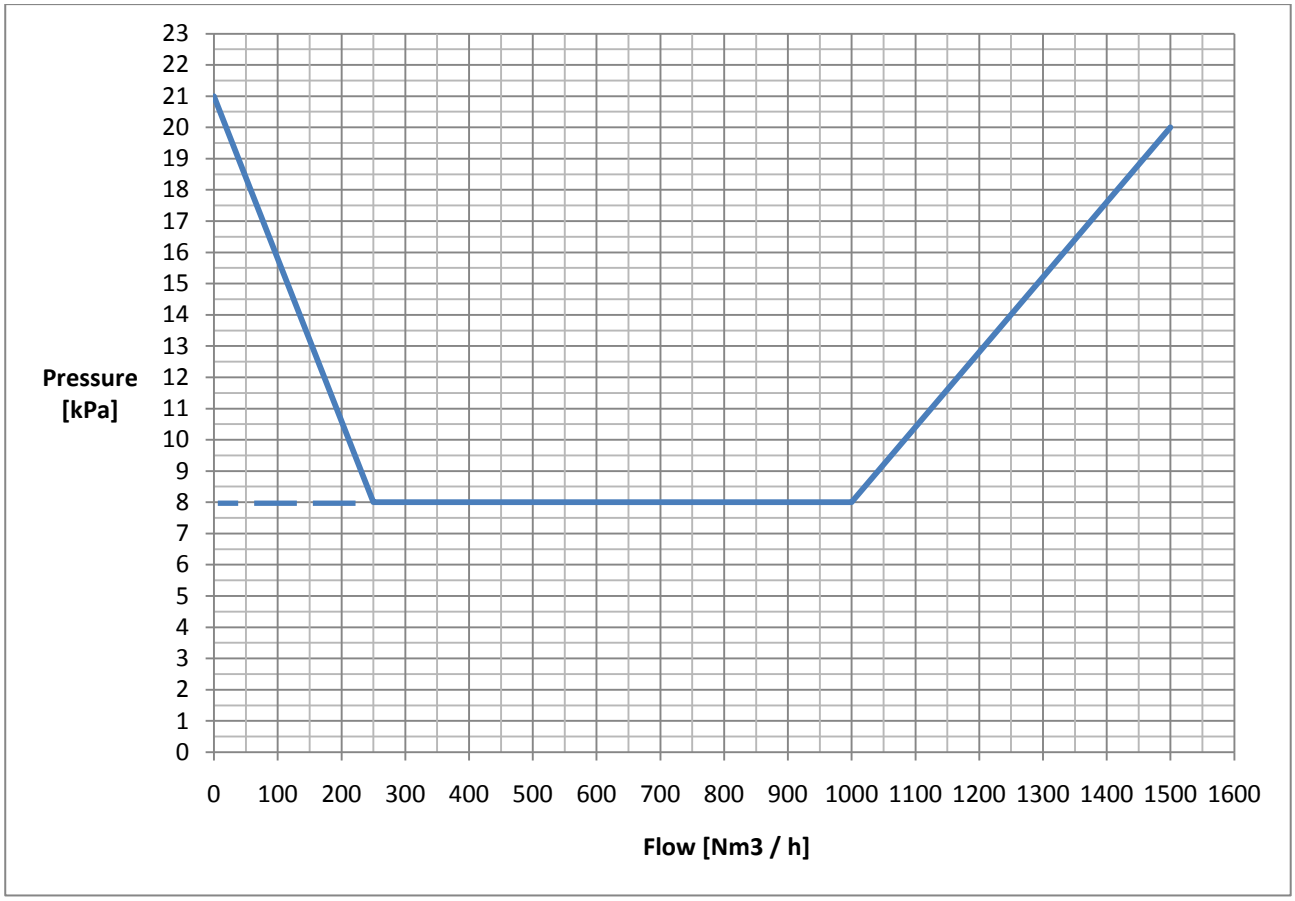
CORRECTIONS?
Please fill in!

Pipe section		**Vecs1**		**Vecs2**		**Vecs3**		**Vecs4**		**Vecs5**		**Vecs6**	
Pipe size		mm		mm		mm		mm		mm		mm	
Pipe length		m		m		m		m		m		m	
Restrictions:	Zeta	Qty.	Zeta	Qty.	Zeta	Qty.	Zeta	Qty.	Zeta	Qty.	Zeta	Qty.	Zeta
Inlet	0,50		0		0		0		0		0		0
Outlet	1,00		0		0		0		0		0		0
Butterfly valve	0,20		0		0		0		0		0		0
Gate valve	0,25		0		0		0		0		0		0
45° bend	0,18		0		0		0		0		0		0
90° bend	0,25		0		0		0		0		0		0
Angle flow in T-pipe	1,52		0		0		0		0		0		0
Angle flow in T-pipe	1,35		0		0		0		0		0		0
Straight flow in T-pipe	0,10		0		0		0		0		0		0
Confluence in T-pipe	3,00		0		0		0		0		0		0
Confluence in T-pipe	0,80		0		0		0		0		0		0
Reducer	0,20		0		0		0		0		0		0
Expansion	0,50		0		0		0		0		0		0
Total Zeta value			0		0		0		0		0		0

P-V Valve flowcurves

Document type:	Document No.:	Notified Body:	Certificate No.:
Flow diagram	90001-1202-125-21	Bureau Veritas	To be informed

PRESSURE SIDE – HIGH VELOCITY VALVE

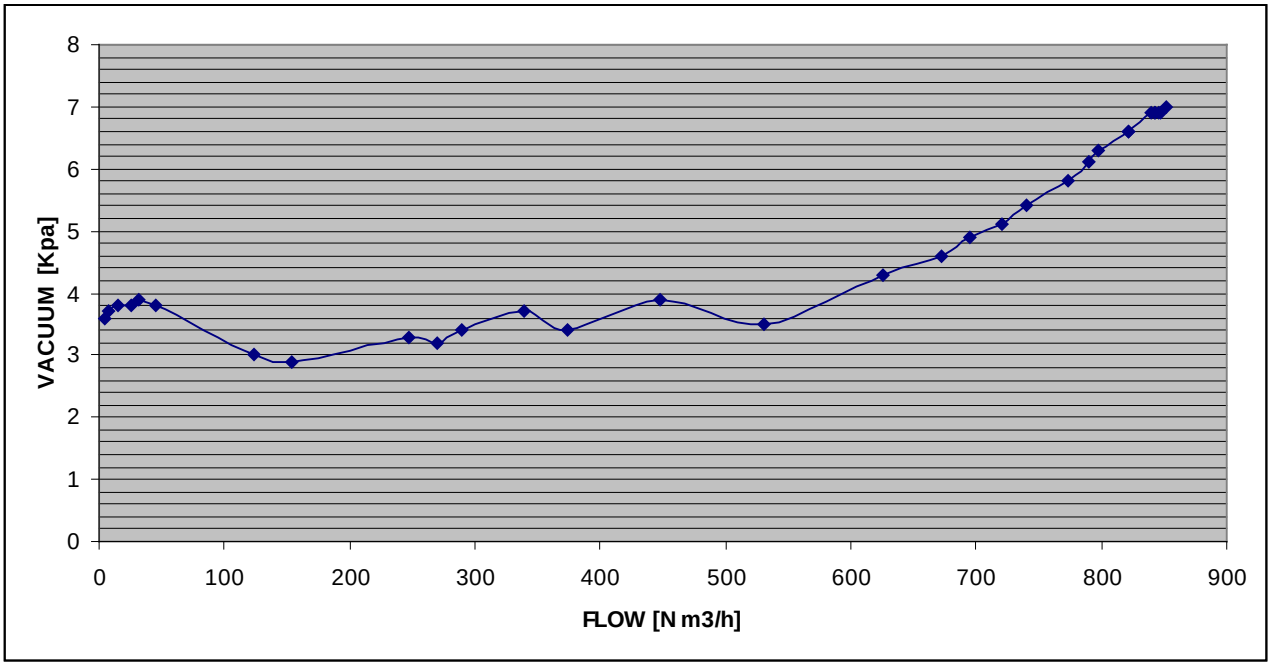


Valve setting:	Lowest setting:	Valve capacity:	Conditions:	
20 Kpa	12 Kpa	1500 Nm³/h @ 20 Kpa	Standard air	21°C / 1013 hPa

	Applicable rules	Valve data		Data	
√	IMO MSC/Circ 677/1009	Name	HI Jet ISO II	Signature / Stamp	
√	ISO 15364	No.	1202		
√	MED 96/98	Size	125		
√	SOLAS 74	**Restrictions:**		**Lenght [m]**	**Bends [No]**
√	API 2000	DN > 80		No restrict.	No restrict.
√	API 520	DN 80		30	11
		DN 80		40	0
		MESG		0,9	

Document type:	Document No.:	Notified Body:	Certificate No.:
Flow diagram	90001-1202-100-002	Bureau Veritas	To be informed

VACUUM SIDE VALVE



Valve setting:	Lowest setting:	Valve capacity:	Conditions:	
-3,5 Kpa	-3,5 Kpa	850 Nm³/h @ 7 Kpa	Standard air	21°C / 1013 hPa

	Applicable rules	Valve data		Data	
√	IMO MSC/Circ 677/1009	Name	HI Jet ISO II	Signature / Stamp	
√	ISO 15364	No.	1202		
√	MED 96/98	Size	100		
√	SOLAS 74	**Restrictions:**		**Lenght [m]**	**Bends [No]**
√	API 2000	DN > 65		na	na
√	API 520	DN 80		na	na
		DN 80		na	na
		MESG	0,9		

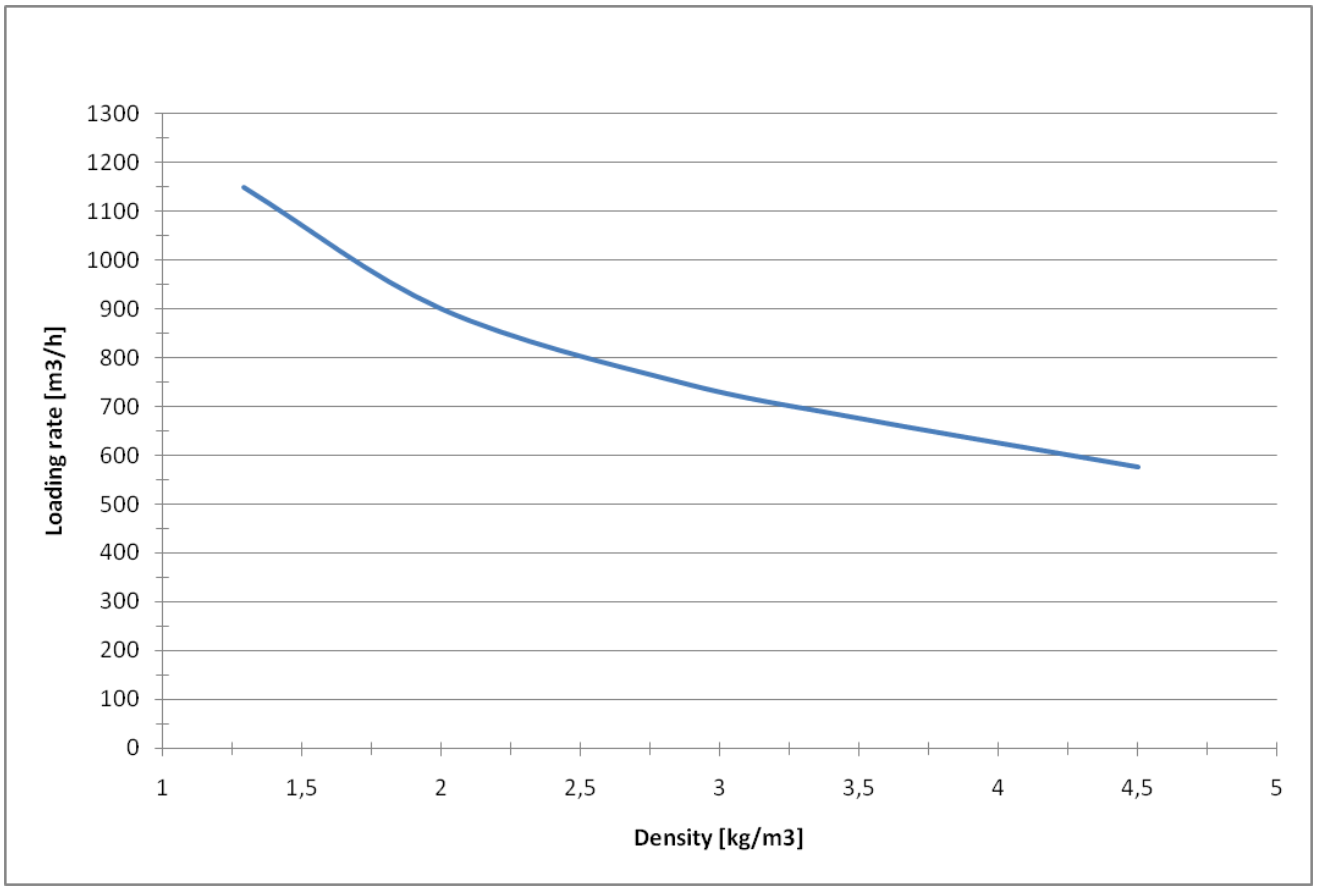
Limitations & Conclusions

Non- VECS limitations			
Max loading	Density	Loading	
	kg/m^3	m^3/h	
Gas density - Air	1,29	1150	
Gas density - Cargo 2	2	900	
Gas density - Propylen oxide	2,85	750	
Gas density - Cargo 4	3,5	675	
Gas density - Cargo 5	4,5	575	
Max un-loading	1,29	725	
Un-loading rate informed		380	
Loading rate informed		380	
Max tank pressure			
at informed loading	Density	Pressure	
	kg/m^3	mm Wg	
Gas density - Air	1,29	874	
Gas density - Cargo 2	2	909	
Gas density - Crude oil	2,85	949	
Gas density - Cargo 4	3,5	979	
Gas density - Cargo 5	4,5	1025	
Un-loading	1,29	395	
USCG VECS limitations			
CFR §39.30-1(d)(3)			
Loading number of tanks	**6**		
Loading cargo	2,85	kg/m^3	
Max Loading per tank	875	m^3/h	
CFR §39.30-1(d)(2)			
Loading number of tanks	6		
Loading cargo	1,29	kg/m^3	
Max Loading	725	m^3/h	
CFR §39.30-1(d)(1)			
Loading number of tanks	6		
Loading cargo	2,85	kg/m^3	
Max Loading per tank	640	m^3/h	
Design pressure of tank	25	kPa	
Setting pressure	20,6		
Setting vacuum	-3,5		
Min tank pressure	-7	kPa	
CONDITIONS INFORMED			
Loading No of tanks	6		
Worst case tank	7	SB	
Tank loaded at the same time - PS	6	5	0
Tank loaded at the same time - SB	6	5	0

Non VECS max loading curve

Vapour growth rate 125 %

Document type:	Document No.:	Notified Body:	Certificate No.:
Loading diagram	95001-10281		To be informed



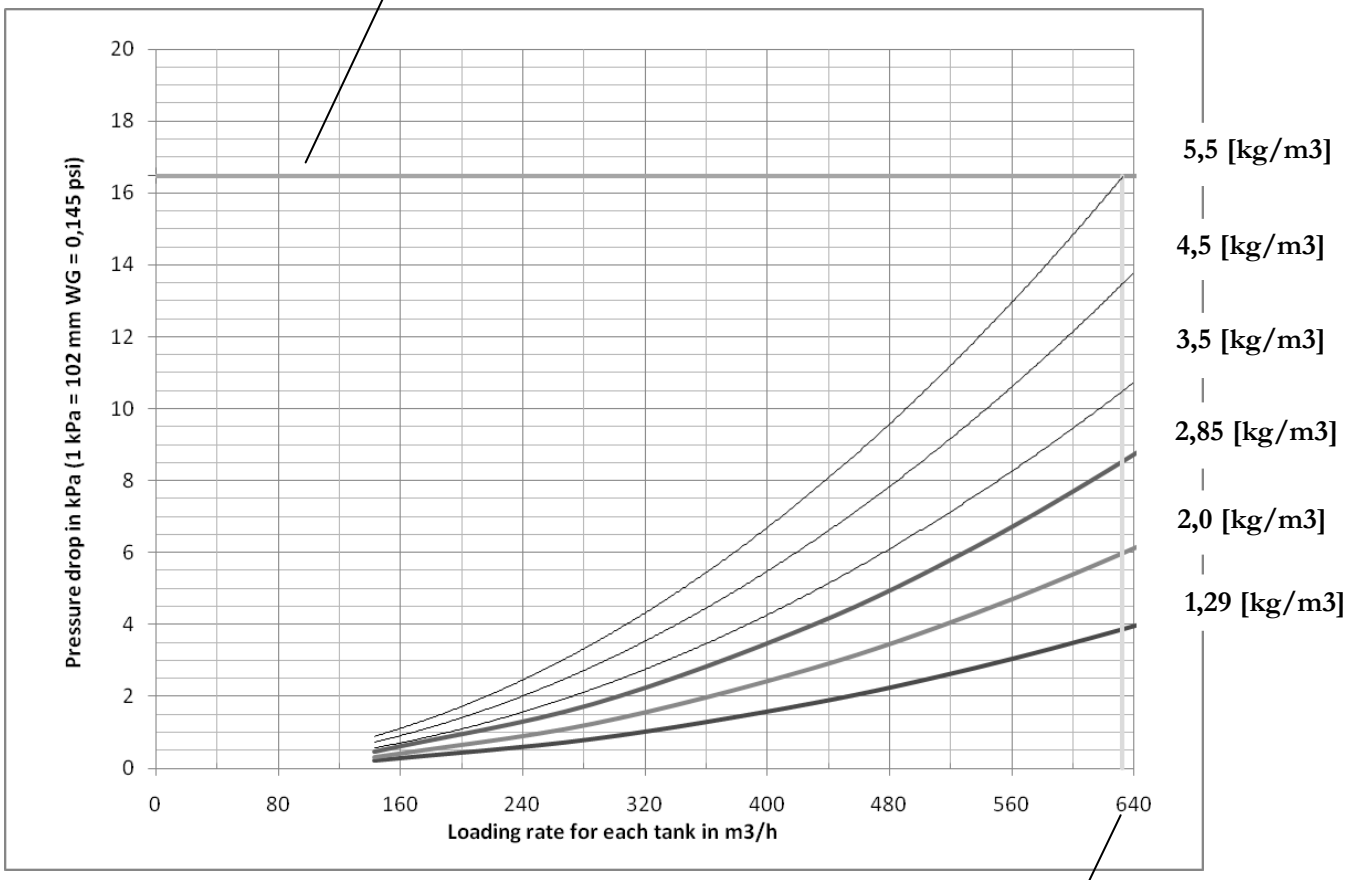
Application!

Venting any tank through the High velocity valve.
The curve states maximum loading of various density cargoes.

VECS - max loading curves

VGR 100
Below curves are applicable when loading stated worst-case tanks simultaneously and venting is done through the vapour return line. The calculations are based on a vapour growth rate of 100 % of the loading rate.

16,48 kpa = 80% of setting



640 m3/h overall limitation
Required by §39.30–1(d)(1).
(1) 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.

Application!

Loading 6 tanks simultaneously - venting through the Vapour return system

Detailed calculations and description

Pressure drop calculations- Non VECS

Venting: 1,29

Symbol	Name	Formula	Number	Unit	comm.
Di	Internal diameter of pipe		125	mm	
L	Length of pipe		42	m	
π	pi		3,1415927		
A	Pipe Area	$A = \frac{\pi}{4} \cdot Di^2$	0,01227	m^2	
	Loading rate	Informed	380		
	Venting rate		499	Vapour growth	
	Venting rate		499	Density correction	
Q	Venting rate	$Q = \frac{V \cdot Di^2 \cdot \pi \cdot 3600s/h}{4}$	499	m^3/h	
V	Velocity of gas in pipe	$V = \frac{Q}{A \cdot 3600s/h}$	11,29	m/s	
GEF	Gas evolution factor		1,25	no dim.	
FF	Fouling factor		1,05	no dim.	
VD	Vapour density		1,29	kg/m^3	
AD	Air density		1,29	kg/m^3	
DF	Density factor	$DF = \sqrt{\frac{VD}{AD}} = \sqrt{\frac{2,85}{1,29}}$	1,000	no dim.	
ν	Gas viscosity(kinematic)		0,000015	m^2/s	
k	Roughness of steelpipe		0,00015	m	
Re	Reynolds number	$Re = \frac{V \cdot Di}{\nu}$	94078	no dim.	
λ	Friction factor, (Itterative algorithm of Colebrook-White)	$\lambda = \frac{1}{\left(-2 \cdot \log\left(\left[\frac{k}{3,7 \cdot Di}\right] + \left[\frac{2,51}{Re \cdot \sqrt{\lambda}}\right]\right)\right)^2}$	0,0222900	no dim.	0,0036
ζ	Resistence faktor	i.e. inlet, outlet, bends etc.		no dim.	
Σζ	Sum of resistences	$\Sigma\zeta = \zeta_1 + \zeta_2 + \cdots \zeta_n$	1,28	no dim.	page 2
$\Sigma\zeta_{total}$	Total resistence	$\Sigma\zeta_{total} = \Sigma\zeta + \lambda \cdot \frac{L}{Di}$	8,77	no dim.	
ΔP	Pressure loss	$\Delta P = \frac{\Sigma\zeta_{total} \cdot V^2 \cdot VD}{2}$	720,9	Pa	
			73,5	mmwc	
			0,105	psi	
	Valve flow curve @	499	**800**	mmWG	
	Max Tank pressure		**873,5**	mmWG	

Venting: 2,00

Symbol	Name	Formula	Number	Unit	comm.
Di	Internal diameter of pipe		125	mm	
L	Length of pipe		42	m	
π	pi		3,141592654		
A	Pipe Area	$A = \frac{\pi}{4} \cdot Di^2$	0,01227	m^2	
	Loading rate	Informed	380		
	Venting rate		499	Vapour growth	
	Venting rate		621	Density correction	
Q	Venting rate	$Q = \frac{V \cdot Di^2 \cdot \pi \cdot 3600s/h}{4}$	621	m^3/h	
V	Velocity of gas in pipe	$V = \frac{Q}{A \cdot 3600s/h}$	14,06	m/s	
GEF	Gas evolution factor		1,25	no dim.	
FF	Fouling factor		1,05	no dim.	
VD	Vapour density		2	kg/m^3	
AD	Air density		1,29	kg/m^3	
DF	Density factor	$DF = \sqrt{\frac{VD}{AD}} = \sqrt{\frac{2,85}{1,29}}$	1,245	no dim.	
ν	Gas viscosity(kinematic)		0,000015	m^2/s	
k	Roughness of steelpipe		0,00015	m	
Re	Reynolds number	$Re = \frac{V \cdot Di}{\nu}$	117141	no dim.	
λ	Friction factor, (Itterative algorithm of Colebrook-White)	$\lambda = \frac{1}{\left(-2 \cdot \log\left(\left[\frac{k}{3,7 \cdot Di}\right] + \left[\frac{2,51}{Re \cdot \sqrt{\lambda}}\right]\right)\right)^2}$	0,0210755	no dim.	0,0036
ζ	Resistence faktor	i.e. inlet, outlet, bends etc.		no dim.	
					page 2
Σζ	Sum of resistences	$\Sigma\zeta = \zeta_1 + \zeta_2 + \cdots \zeta_n$	1,28	no dim.	
$\Sigma\zeta_{total}$	Total resistence	$\Sigma\zeta_{total} = \Sigma\zeta + \lambda \cdot \frac{L}{Di}$	8,36	no dim.	
ΔP	Pressure loss	$\Delta P = \frac{\Sigma\zeta_{total} \cdot V^2 \cdot VD}{2}$	1065,7	Pa	
			108,7	mmwc	
			0,155	psi	
	Valve flow curve @	621	**800**	mmWG	
	Max Tank pressure		**908,7**	mmWG	

Venting: 2,85

Symbol	Name	Formula	Number	Unit	comm.
Di	Internal diameter of pipe		125	mm	
L	Length of pipe		42	m	
π	pi		3,141592654		
A	Pipe Area	$A = \frac{\pi}{4} \cdot Di^2$	0,01227	m^2	
	Loading rate	Informed	380		
	Venting rate		499	Vapour growth	
	Venting rate		741	Density correction	
Q	Venting rate	$Q = \frac{V \cdot Di^2 \cdot \pi \cdot 3600s/h}{4}$	741	m^3/h	
V	Velocity of gas in pipe	$V = \frac{Q}{A \cdot 3600s/h}$	16,78	m/s	
GEF	Gas evolution factor		1,25	no dim.	
FF	Fouling factor		1,05	no dim.	
VD	Vapour density		2,85	kg/m^3	
AD	Air density		1,29	kg/m^3	
DF	Density factor	$DF = \sqrt{\frac{VD}{AD}} = \sqrt{\frac{2,85}{1,29}}$	1,486	no dim.	
ν	Gas viscosity(kinematic)		0,000015	m^2/s	
k	Roughness of steelpipe		0,00015	m	
Re	Reynolds number	$Re = \frac{V \cdot Di}{\nu}$	139835	no dim.	
λ	Friction factor, (Itterative algorithm of Colebrook-White)	$\lambda = \frac{1}{\left(-2 \cdot \log\left(\left[\frac{k}{3,7 \cdot Di}\right] + \left[\frac{2,51}{Re \cdot \sqrt{\lambda}}\right]\right)\right)^2}$	0,0201657	no dim.	0,0036
ζ	Resistence faktor	i.e. inlet, outlet, bends etc.		no dim.	
					page 2
Σζ	Sum of resistences	$\Sigma\zeta = \zeta_1 + \zeta_2 + \cdots \zeta_n$	1,28	no dim.	
$\Sigma\zeta_{total}$	Total resistence	$\Sigma\zeta_{total} = \Sigma\zeta + \lambda \cdot \frac{L}{Di}$	8,06	no dim.	
ΔP	Pressure loss	$\Delta P = \frac{\Sigma\zeta_{total} \cdot V^2 \cdot VD}{2}$	1463,0	Pa	
			149,2	mmwc	
			0,212	psi	
	Valve flow curve @	741	**800**	mmWG	
	Max Tank pressure		**949,2**	mmWG	

Venting: 3,50

Symbol	Name	Formula	Number	Unit	comm.
Di	Internal diameter of pipe		125	mm	
L	Length of pipe		42	m	
π	pi		3,141592654		
A	Pipe Area	$A = \frac{\pi}{4} \cdot Di^2$	0,01227	m^2	
	Loading rate	Informed	380		
	Venting rate		499	Vapour growth	
	Venting rate		822	Density correction	
Q	Venting rate	$Q = \frac{V \cdot Di^2 \cdot \pi \cdot 3600s/h}{4}$	822	m^3/h	
V	Velocity of gas in pipe	$V = \frac{Q}{A \cdot 3600s/h}$	18,60	m/s	
GEF	Gas evolution factor		1,25	no dim.	
FF	Fouling factor		1,05	no dim.	
VD	Vapour density		3,5	kg/m^3	
AD	Air density		1,29	kg/m^3	
DF	Density factor	$DF = \sqrt{\frac{VD}{AD}} = \sqrt{\frac{2,85}{1,29}}$	1,647	no dim.	
ν	Gas viscosity(kinematic)		0,000015	m^2/s	
k	Roughness of steelpipe		0,00015	m	
Re	Reynolds number	$Re = \frac{V \cdot Di}{\nu}$	154963	no dim.	
λ	Friction factor, (Itterative algorithm of Colebrook-White)	$\lambda = \frac{1}{\left(-2 \cdot \log\left(\left[\frac{k}{3,7 \cdot Di}\right] + \left[\frac{2,51}{Re \cdot \sqrt{\lambda}}\right]\right)\right)^2}$	0,0196648	no dim.	0,0036
ζ	Resistence faktor	i.e. inlet, outlet, bends etc.		no dim.	
					page 2
Σζ	Sum of resistences	$\Sigma\zeta = \zeta_1 + \zeta_2 + \cdot\cdot\cdot\cdot\cdot \zeta_n$	1,28	no dim.	
$\Sigma\zeta_{total}$	Total resistence	$\Sigma\zeta_{total} = \Sigma\zeta + \lambda \cdot \frac{L}{Di}$	7,89	no dim.	
ΔP	Pressure loss	$\Delta P = \frac{\Sigma\zeta_{total} \cdot V^2 \cdot VD}{2}$	1759,2	Pa	
			179,4	mmwc	
			0,255	psi	
	Valve flow curve @	822	**800**	mmWG	
	Max Tank pressure		**979,4**	mmWG	

Venting: 4,50

Symbol	Name	Formula	Number	Unit	comm.
Di	Internal diameter of pipe		125	mm	
L	Length of pipe		42	m	
π	pi		3,141592654		
A	Pipe Area	$A = \frac{\pi}{4} \cdot Di^2$	0,01227	m^2	
	Loading rate	Informed	380		
	Venting rate		499	Vapour growth	
	Venting rate		932	Density correction	
Q	Venting rate	$Q = \frac{V \cdot Di^2 \cdot \pi \cdot 3600s/h}{4}$	932	m^3/h	
V	Velocity of gas in pipe	$V = \frac{Q}{A \cdot 3600s/h}$	21,09	m/s	
GEF	Gas evolution factor		1,25	no dim.	
FF	Fouling factor		1,05	no dim.	
VD	Vapour density		4,5	kg/m^3	
AD	Air density		1,29	kg/m^3	
DF	Density factor	$DF = \sqrt{\frac{VD}{AD}} = \sqrt{\frac{2,85}{1,29}}$	1,868	no dim.	
ν	Gas viscosity(kinematic)		0,000015	m^2/s	
k	Roughness of steelpipe		0,00015	m	
Re	Reynolds number	$Re = \frac{V \cdot Di}{\nu}$	175712	no dim.	
λ	Friction factor, (Itterative algorithm of Colebrook-White)	$\lambda = \frac{1}{\left(-2 \cdot \log\left(\left[\frac{k}{3,7 \cdot Di}\right] + \left[\frac{2,51}{Re \cdot \sqrt{\lambda}}\right]\right)\right)^2}$	0,0190771	no dim.	0,0036
ζ	Resistence faktor	i.e. inlet, outlet, bends etc.		no dim.	
					page 2
Σζ	Sum of resistences	$\Sigma\zeta = \zeta_1 + \zeta_2 + \cdots \zeta_n$	1,28	no dim.	
$\Sigma\zeta_{total}$	Total resistence	$\Sigma\zeta_{total} = \Sigma\zeta + \lambda \cdot \frac{L}{Di}$	7,69	no dim.	
ΔP	Pressure loss	$\Delta P = \frac{\Sigma\zeta_{total} \cdot V^2 \cdot VD}{2}$	2205,2	Pa	
			224,9	mmwc	
			0,320	psi	
	Valve flow curve @	932	**800**	mmWG	
	Max Tank pressure		**1024,9**	mmWG	

Vacuum: 1,29 – unloading

>	Name	Formula	Number	Unit	comm.
Di	Internal diameter of pipe		125	mm	
L	Length of pipe		42	m	
π	pi		3,1415927		
A	Pipe Area	$A = \frac{\pi}{4} \cdot Di^2$	0,01227	m^2	
	Loading rate	Informed	380		
	Venting rate		380	Vapour growth	
	Venting rate		380	Density correction	
Q	Venting rate	$Q = \frac{V \cdot Di^2 \cdot \pi \cdot 3600s/h}{4}$	380	m^3/h	
V	Velocity of gas in pipe	$V = \frac{Q}{A \cdot 3600s/h}$	8,60	m/s	
GEF	Gas evolution factor		1	no dim.	
FF	Fouling factor		1	no dim.	
VD	Vapour density		1,29	kg/m^3	
AD	Air density		1,29	kg/m^3	
DF	Density factor	$DF = \sqrt{\frac{VD}{AD}} = \sqrt{\frac{2,85}{1,29}}$	1,000	no dim.	
ν	Gas viscosity(kinematic)		0,000015	m^2/s	
k	Roughness of steelpipe		0,00015	m	
Re	Reynolds number	$Re = \frac{V \cdot Di}{\nu}$	71679	no dim.	
λ	Friction factor, (Itterative algorithm of Colebrook-White)	$\lambda = \frac{1}{\left(-2 \cdot \log\left(\left[\frac{k}{3,7 \cdot Di}\right] + \left[\frac{2,51}{Re \cdot \sqrt{\lambda}}\right]\right)\right)^2}$	0,0239482	no dim.	0,0036
ζ	Resistence faktor	i.e. inlet, outlet, bends etc.		no dim.	
					page 2
Σζ	Sum of resistences	$\Sigma\zeta = \zeta_1 + \zeta_2 + \cdots \zeta_n$	1,28	no dim.	
$\Sigma\zeta_{total}$	Total resistence	$\Sigma\zeta_{total} = \Sigma\zeta + \lambda \cdot \frac{L}{Di}$	9,33	no dim.	
ΔP	Pressure loss	$\Delta P = \frac{\Sigma\zeta_{total} \cdot V^2 \cdot VD}{2}$	445,1	Pa	
			45,4	mmwc	
			0,065	psi	
	Valve flow curve @	380	**350**	mmWG	
	Max Tank pressure		**395,4**	mmWG	

USCG Vapour Return System

VECS - max loading curves

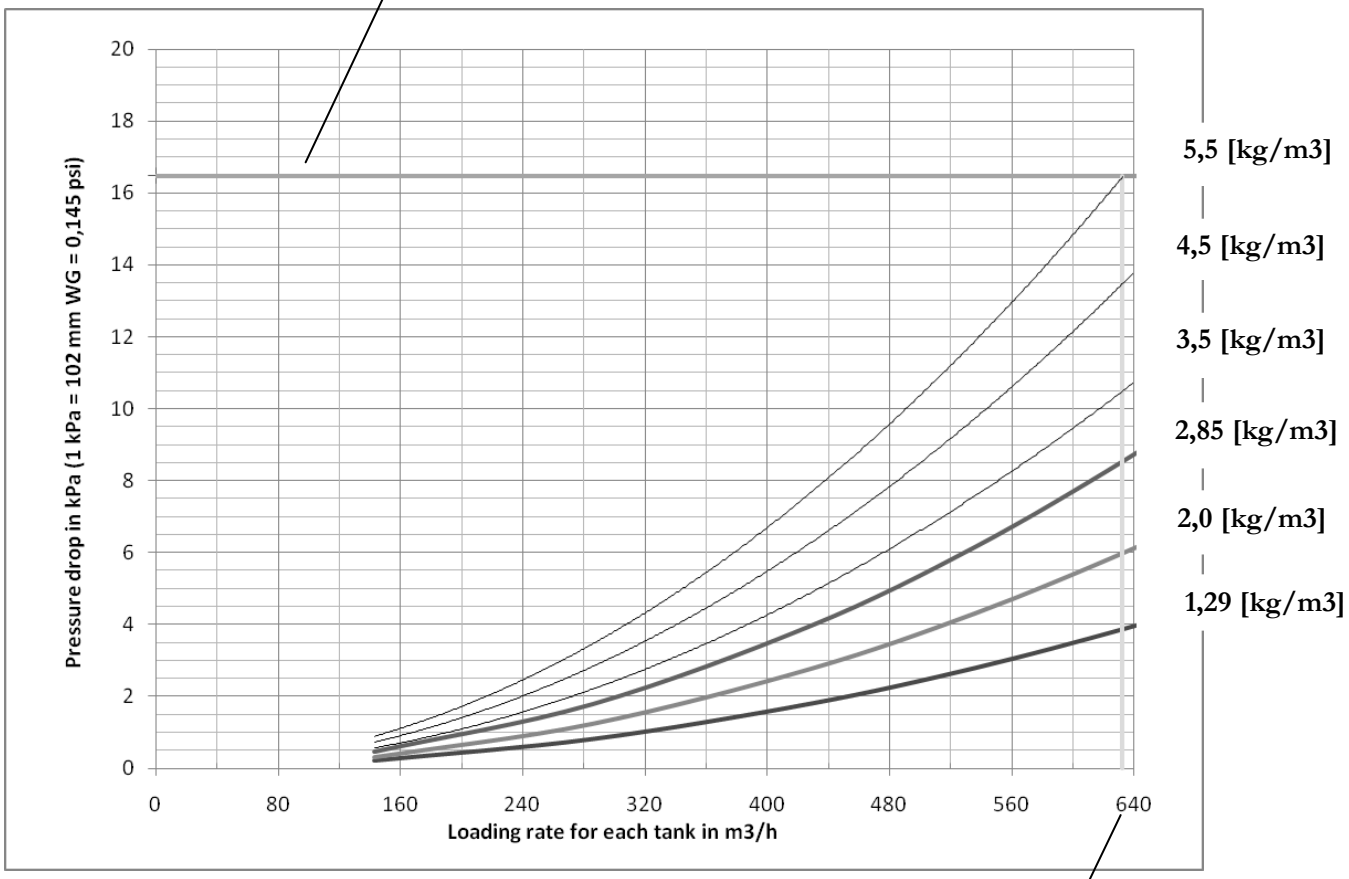
Below curves are applicable when loading stated worst-case tanks simultaneously and venting is done through the vapour return line.

VECS - max loading curves

VGR 100

Below curves are applicable when loading stated worst-case tanks simultaneously and venting is done through the vapour return line. The calculations are based on a vapour growth rate of 100 % of the loading rate.

16,48 kpa = 80% of setting



640 m3/h overall limitation

Required by §39.30–1(d)(1).
(1) 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.

Loading 6 tanks simultaneously - venting through the Vapour return system

VECS - Pressure drop calculations

VECS - Max. venting capacity is limited to 80% CFR 46 §39.30–1(d)(1)

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

Symbol	Name	Formula	Number	Unit	comm.
Di	Internal diameter of pipe		125	mm	
L	Length of pipe		42	m	
π	pi		3,141592654		
A	Pipe Area	$A = \frac{\pi}{4} \cdot Di^2$	0,01227	m^2	
	Loading rate	Informed	800		
	Venting rate		1000	Vapour growth	
	Venting rate		1486	Density correction	
Q	Venting rate	$Q = \frac{V \cdot Di^2 \cdot \pi \cdot 3600s/h}{4}$	1486	m^3/h	
V	Velocity of gas in pipe	$V = \frac{Q}{A \cdot 3600s/h}$	33,64	m/s	
GEF	Gas evolution factor		1,25	no dim.	
FF	Fouling factor		1	no dim.	
VD	Vapour density		2,85	kg/m^3	
AD	Air density		1,29	kg/m^3	
DF	Density factor	$DF = \sqrt{\frac{VD}{AD}} = \sqrt{\frac{2,85}{1,29}}$	1,486	no dim.	
ν	Gas viscosity(kinematic)		0,000015	m^2/s	
k	Roughness of steelpipe		0,00015	m	
Re	Reynolds number	$Re = \frac{V \cdot Di}{\nu}$	280372	no dim.	
λ	Friction factor, (Itterative algorithm of Colebrook-White)	$\lambda = \frac{1}{\left(-2 \cdot \log\left(\left[\frac{k}{3,7 \cdot Di}\right] + \left[\frac{2,51}{Re \cdot \sqrt{\lambda}}\right]\right)\right)}$	0,0171087	no dim.	0,0036
ζ	Resistence faktor	i.e. inlet, outlet, bends etc.		no dim.	
					page 2
Σζ	Sum of resistences	$\Sigma\zeta = \zeta_1 + \zeta_2 + \cdots \zeta_n$	1,28	no dim.	
$\Sigma\zeta_{total}$	Total resistence	$\Sigma\zeta_{total} = \Sigma\zeta + \lambda \cdot \frac{L}{Di}$	7,03	no dim.	
ΔP	Pressure loss	$\Delta P = \frac{\Sigma\zeta_{total} \cdot V^2 \cdot VD}{2}$	5131,6	Pa	
			523,4	mmwc	
			0,744	psi	
	Valve flow curve @	1486	**2000**	mmWG	
	Max Tank pressure <	Design pressure	**2523,4**	mmWG	

Required by §39.30–1(d)(1).
(1) 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.

Conclusion: Max. loading at 80% valve capacity = 640 m3/h

VECS - Max. vacuum relieving capacity CFR 46 §39.30–1(d)(2)

USCG CFR 46 § 39.30
(d) The rate of cargo transfer must not exceed the maximum allowable transfer rate as determined by the lesser of the following:

Symbol	Name	Formula	Number	Unit	comm.
Di	Internal diameter of pipe		125	mm	
L	Length of pipe		42	m	
π	pi		3,141592654		
A	Pipe Area	$A = \frac{\pi}{4} \cdot Di^2$	0,01227	m^2	
	Un-Loading rate	max	725		
	Venting rate		725	Vapour growth	
	Venting rate		725	Density correction	
Q	Venting rate	$Q = \frac{V \cdot Di^2 \cdot \pi \cdot 3600s/h}{4}$	725	m^3/h	
V	Velocity of gas in pipe	$V = \frac{Q}{A \cdot 3600s/h}$	16,41	m/s	
GEF	Gas evolution factor		1	no dim.	
FF	Fouling factor		1	no dim.	
VD	Vapour density		1,29	kg/m^3	
AD	Air density		1,29	kg/m^3	
DF	Density factor	$DF = \sqrt{\frac{VD}{AD}} = \sqrt{\frac{2,85}{1,29}}$	1,000	no dim.	
ν	Gas viscosity(kinematic)		0,000015	m^2/s	
k	Roughness of steelpipe		0,00015	m	
Re	Reynolds number	$Re = \frac{V \cdot Di}{\nu}$	136755	no dim.	
λ	Friction factor, (Itterative algorithm of Colebrook-White)	$\lambda = \frac{1}{\left(-2 \cdot \log\left(\left[\frac{k}{3,7 \cdot Di}\right] + \left[\frac{2,51}{Re \cdot \sqrt{\lambda}}\right]\right)\right)^2}$	0,0202769	no dim.	0,0036
ζ	Resistence faktor	i.e. inlet, outlet, bends etc.		no dim.	
Σζ	Sum of resistences	$\Sigma\zeta = \zeta_1 + \zeta_2 + \cdots \zeta_n$	1,28	no dim.	page 2
$\Sigma\zeta_{total}$	Total resistence	$\Sigma\zeta_{total} = \Sigma\zeta + \lambda \cdot \frac{L}{Di}$	8,09	no dim.	
ΔP	Pressure loss	$\Delta P = \frac{\Sigma\zeta_{total} \cdot V^2 \cdot VD}{2}$	1405,8	Pa	
			143,4	mmwc	
			0,204	psi	
	Valve flow curve @	725	**550**	mmWG	
	Max Tank Vacuum <	Design pressure	**693,4**	mmWG	

Required by §39.30–1(d)(2
(2) The total vacuum relieving capacity of the vacuum relief valves in the cargo tank venting system when relieving at the set pressure.

Conclusion: Max. loading = 725 m3/h

VECS - Max. pressure is limited to 80% CFR 46 §39.30–1(d)(3)

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

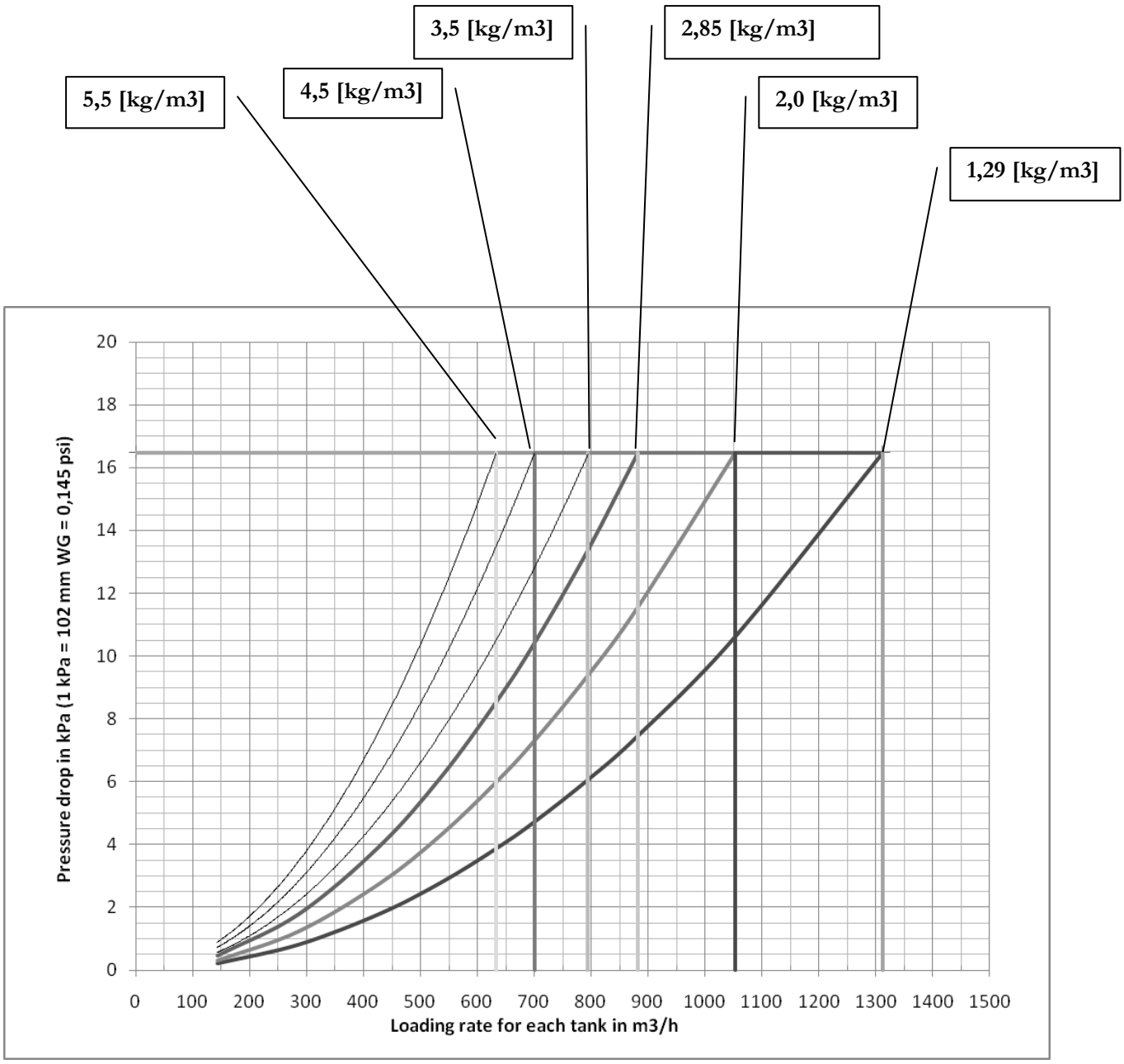
		LOADING TANKS		6	Density of gas		2,85
100% Q	Pipe				kPa	mm VS	
m^3/h	kPa		Valve set point		20,6	2102	
875	16,353		80% of setting		16,48	1682	
Section							
Pipe 1		Pipe ø (m)=	0,125	Length=	42		
Q	v	Lambda	Zeta f	Zeta c	Total zeta	pa	mm VS
875	19,81	0,023	7,79	4,29	12,08	6755	689
Vecs1	4	Pipe ø (m)=	0,25	Length=	1,2		
Q	v	Lambda	Zeta f	Zeta c	Total zeta	pa	mm VS
3.500	19,81	0,022	0,11	3,25	3,36	1877	191
Vecs2	6	Pipe ø (m)=	0,25	Length=	25,6		
Q	v	Lambda	Zeta f	Zeta c	Total zeta	pa	mm VS
5.250	29,71	0,022	2,28	3,86	6,14	7721	787

Required by §39.30–1(d)(3
3) The rate based on pressure drop calculations at which, for a given pressure at the facility vapor connection, or if lightering at the vapor connection of the vessel receiving cargo, the pressure in any cargo tank connected to the vapor collection system exceeds 80 percent of the setting of any pressure relief valve in the cargo tank venting system required.

Conclusion: Max loading = 875 m3/h

VGR 100

Below curves are applicable when loading stated worst-case tanks simultaneously and venting is done through the vapour return line. The calculations are based on a vapour growth rate of 100 % of the loading rate.



Application!

Loading 6 tanks simultaneously - venting through the Vapour return system

Detailed Rules & background

VECS - Calculation of Gas Return Lines CFR 46 §39.30

This part applies to each tank vessel operating in the navigable waters of the United States, when collecting vapors of crude oil, gasoline blends, or benzene emitted from a vessel's cargo tanks through a vapor control system.

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

(1) 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 §39.30–1(d)(1).

(2) The total vacuum relieving capacity of the vacuum relief valves in the cargo tank venting system when relieving at the set pressure required by §39.30–1(d)(2).

3) The rate based on pressure drop calculations at which, for a given pressure at the facility vapor connection, or if lightering at the vapor connection of the vessel receiving cargo, the pressure in any cargo tank connected to the vapor collection system exceeds 80 percent of the setting of any pressure relief valve in the cargo tank venting system required by §39.30–1(d)(3)

Guidelines

Background for determination of the vapour/air mixture density and the vapour growth rate

According to U.S. Coast Guard, the below mentioned guidelines should be used for calculation of the density of gas and the flow rate.

GUIDELINES FOR DETERMINING THE MAXIMUM LIQUID TRANSFER RATE FOR A TANK VESSEL TRANSFERRING A FLAMMABLE OR COMBUSTIBLE CARGO USING A VAPOUR CONTROL SYSTEM.

The document provides guidance from the Coast Guard Marine Safety Centre for determining the maximum liquid transfer rate for a tank vessel using vapour control system while transferring a flammable or combustible cargo.
The vapour control system requirements in 46 Code of Federal Regulations (CFR) Part 39 for benzene, crude oil and gasoline remain unchanged.

Condition of the Vapour Space inside the Cargo Tank.

A temperature of 115 °F and a pressure equal to the pressure setting of the cargo tank P/V valve should be used in the calculations to determine the factor that limits the transfer rate. A temperature of 115 °F was chosen because it is the reference temperature for the design pressure of cargo tanks as specified in 46 CFR 151.15-3, and the IMO Chemical Codes (BCH (4.11) and IBC (15.14)), and because it may be typical of conditions in many areas.
If the cargo tank P/V valves are adequately sized, the maximum pressure inside the cargo space should be only slightly higher than the pressure setting of the P/V valves. The temperature and pressure used is important because the vapour-air mixture weight density and vapour growth rate are affected by the temperature and pressure of the vapour space in the cargo tank.

Determining Vapour-air Mixture Density:

Cargoes with a Saturated Vapour Pressure of 14,7 psia or less at 115 °F.

Ideal gas laws may be used to estimate the density of the vapour-air mixture in the vapour space of the cargo tank.
With equation (1) defining the relationship between partial pressures and partial volumes and equation (2) defining the maximum total pressure of the vapour space inside the cargo tank, equation (3) may be used to calculate the vapour-air mixture weight density.
If the cargo tank is not inerted, the air weight density in equation (3) may be substituted with equation (4) leading to equation (5).

Pt, 115 = Pp/v (2)
ϱv-a, 115 = ((SGv x Vv, 115) + Va, 115) ϱa, 115 (3)
ϱa, 115 = 0,0047 Pp/v (4)
ϱv-a, 115 = ((SGv x Vv, 115) + Va, 115) 0,0047 Pp/v (5)
ϱv-a, 115 = vapour-air weight density at 115 °F and the pressure setting of the cargo tank P/V valves [lbm/ft3]
ϱa, 115 = air weight density at 115 °F and the pressure setting of the cargo tank P/V valves [lbm/ft3]
Va, 115 = partial volume of air at 115 °F
Vv, 115 = partial volume of vapour at 115 °F
SGv = specific gravity of vapour
Pv, 115 = saturated vapour pressure at 115 °F [psia]
Pt, 115 = total vapour-air pressure at 115 °F [psia]
Pp/v = cargo tank P/V valve pressure setting [psia]

Saturated vapour pressures at 115 °F (Pv,115) and cargo vapour specific gravities (SGv) may be obtained from various sources including the Coast Guard's Chemical Data Guide for Bulk Shipment by Water (CIM 16616.6A) and CHRIS Hazardous Chemical Data Manual (COMDTINST M16465.12B).

Cargoes with a Saturated Vapour Pressure Greater Than 14,7 psia at 115 °F

Saturated vapour weight density at 115 °F from CHRIS Manual or estimates as determined by equation (6) may be used:

$$pv\text{- }a,115 = \frac{(SGv)\ (pv,115)\ (0{,}0047\ P\ p/v)}{14{,}7}$$

Determining the Vapour Growth Rate:

During cargo loading, some of the cargo will change from the liquid phase to the vapour phase (evaporate) until the pressure in the cargo tank vapour space reaches the saturation pressure of the cargo. If vapours are being removed from the cargo tank through a vapour control system, the saturation pressure is never reached and the evaporation of the cargo continues throughout the loading operation. As a result, the volume of the vapour emitted from the cargo tank is equal to the volume that is displaced by the incoming cargo plus the volume of the cargo vapours that have evaporated. The rate of evaporation is cargo dependent and is called the cargo's vapour growth rate (VGR).

The rate of evaporation is influenced by following factors:

1. The area of the exposed surface of the liquid

2. The temperature of the liquid and the air above it
3. The movement of the air above the surface of the liquid
4. The amount of cargo in vapour phase relative to amount at saturation

Cargoes with a Saturated Vapour Pressure of 12,5 psia or less at 115 °F

Using gasoline as a baseline cargo with an assumed vapour growth rate of 25% equation (7) may be used to estimate the vapour growth rates of other cargoes:

$$VGR = 1 + 0{,}25 \frac{P_{v,115}}{12{,}5}$$

Where:

VGR = vapour growth rate
Pv, 115 = saturated vapour pressure at 115 °F [psia]

Cargoes with a Saturated vapour pressure greater than 12,5 psia at 115 °F
A VGR of 1,25 may be used if the saturated vapour weight density using equation (6) is used. It has been determined that using these two values in the pressure drop calculations gives a worse case loading scenario. Use of a VGR greater than 1,25 and a vapour weight density that differs from that given in equation (6) can only be used with permission of Commandant (G-MTH-1).

Theoretically pressure drop calculations

The pressure drop calculations are based on the following parameters:

Nomenclature	Description	Dimension
Q	Venting rate	m^3/h
Q_a	Venting rate	Nm^3/h
d	Internal pipe diameter	m
l	Pipe length	m
v	Gas velocity in pipe	m/s
ν	Kinematic viscosity of gas	m^2/s
k	Roughness of pipe	m
ρ	Density of gas	kg/m^3
ρ_a	Density of air at 0 °C and barometric pressure 1013 hPa	kg/m^3
Re	Reynolds number	dimensionless
λ	Coefficient of resistance for pipe friction	dimensionless
ζ_c	Coefficient of resistance for single component	dimensionless
$\Sigma\zeta_c$	Sum of coefficient of resistances for single components	dimensionless
$\Sigma\zeta$	Total coefficient of resistance	dimensionless
Δp	Pressure loss	Pa

The pressure drop calculations are carried out as follows:

Determination of gas velocity:

$$v = \frac{Q \times 4}{d^2 \times 3600 \times \pi}$$

Determination of Reynolds number:

$$Re = \frac{v \times d}{\nu}$$

Determination of sum of coefficient of resistances for n single components:

$$\Sigma\zeta_c = \zeta_{c1} + \zeta_{c2} + \cdots + \zeta_{cn}$$

Determination of coefficient of resistance for pipe friction is accomplished by solving Colebrooks and Whites formula, which is valid for turbulent flow:

$$\lambda = \frac{1}{\left[2 \cdot \log\left(\frac{2{,}51}{Re \cdot \sqrt{\lambda}} + 0{,}27 \cdot \frac{k}{d}\right)\right]^2}$$

Determination of total coefficient of resistance:

$$\Sigma\zeta = \Sigma\zeta_c + \lambda \cdot \frac{l}{d}$$

Determination of pressure drop:

$$\Delta p = \frac{\Sigma\zeta \cdot \rho \cdot v^2}{2}$$

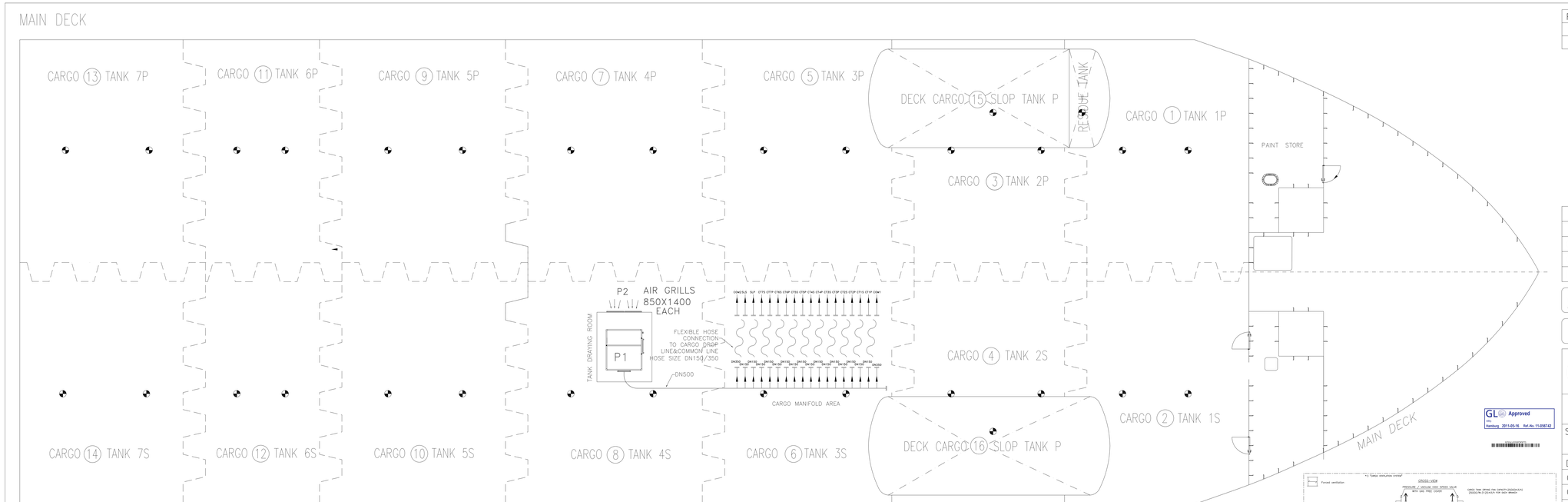
$$Q_a = Q\sqrt{\frac{\rho}{\rho_a}}$$

Equivalent flow rate in Nm^3/h:
Should you have any questions, or require further information related to our offer or any other cargo tank ventilation issue, please do not hesitate to contact the undersigned or our office, and we will be pleased to assist you.

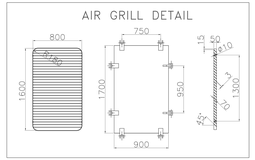
Best regards,
BAY Valves ApS

Søren Bay Jensen

ADDENDUM 2



POS.	QUAN.	DESIGNATION	TYPE	CAPACITY–SIZE
P1	1	CARGO&SLOP TANKS VENT. FAN	NON–SPARKING EEXD–IIC–T4	Q : 25000 m^3/h
P2	2	AIR GRILL		1400x850



NOTE : TANK DRYING MAIN PIPES SELECTED AS SCH 40 GALVANISED TYPE

02	CALCULATION REVISED	12/05/11	M.SAYIN	T.GENCER
01	AS BUILT	27/04/11	M.SAYIN	T.GENCER
NO	REVISION NOTE	DATE	REVISED BY	CHECKED BY

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ADMARIN
DESIGNERS
CONSULTANTS
CONTRACTORS

25000 DWT
TYPE II
OIL/CHEMICAL TANKER

TANK DRYING SYSTEM

SHIPYARD	TURKER SHIPYARD	HULL NO	17/19
		CLASS	G.L.
DESIGN	O.ALTAN DEMIRSOYLU		
CAD	OSMAN ACIPINAR		
CONTROL	AYKUT YILMAZ		
OWNER	GALATA DENIZCILIK	DATE	19/11/2009
		SCALE	–
		DRW'N	CT84–0–82CF

GL Approved
Hamburg 2011-05-16 Ref.No. 11-056742

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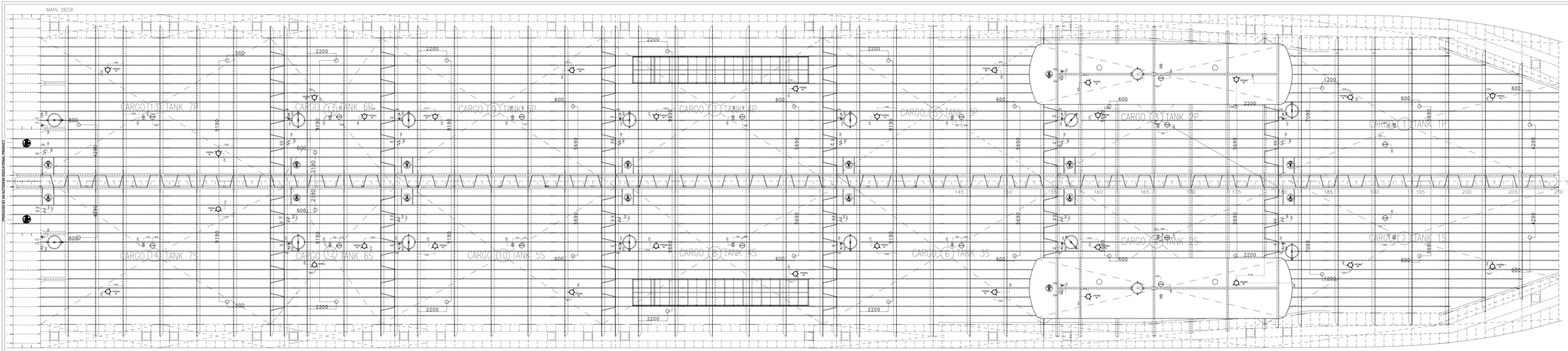
ADDENDUM 3



Temperature Sensor
High Level Alarm
Radar
Manual Sounding
Heating Coil
Tank Wash Machine

Remarks in the letter to be observed
GL Noted
Hamburg 2011-05-10 Ref.No. 11-050486

NO	REVISION NOTE	DATE	REVISED BY	CHECKED BY
1	AS BUILT	27/04/11	M.SAYIN	T.GENCER

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BU DIZAYN VE BUNUNLA ILGILI RESIMLERIN TELIF HAKLARI "O.ALTAN DEMIRSOYLU" YA AITTIR. O.ALTAN DEMIRSOYLUNUN YAZILI MUSADESI OLMADAN BU DOKUMAN VEYA BUNUN BIR KISMI UCUNCU SAHISLARA VERILEMEZ, TEKSIR VEYA KOPYA EDILEMEZ VE HER NE MAKSATLA OLURSA OLSUN MAKSADI DISINDA KULLANILAMAZ

ADMARIN
DESIGNERS
CONSULTANTS
CONTRACTORS

25000 DWT
TYPE II
OIL/CHEMICAL TANKER

CARGO TANKS ACCESSORIES ARRANGEMENT

SHIPYARD	TURKER	HULL NO	17/19
		CLASS	GL
DESIGN	O.ALTAN DEMIRSOYLU		
CAD	MASALLAH ERDEN		
CONTROL	AYKUT YILMAZ		
OWNER	GALATA DENIZCILIK	DATE	16/10/2008
		SCALE	1/100
		DRW'N	CT84-0-06/A

RECORD NO		COPY NO		COPY DATE	

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ADDENDUM 4

[Code of Federal Regulations]
[Title 46, Volume 5]
[Revised as of October 1, 2005]
From the U.S. Government Printing Office via GPO Access
[CITE: 46CFR150.170]

[Page 24-58]

TITLE 46--SHIPPING
CHAPTER I--COAST GUARD, DEPARTMENT OF HOMELAND SECURITY (CONTINUED)

PART 150_COMPATIBILITY OF CARGOES--Table of Contents

Sec. 150.170 Right of appeal.

Any person directly affected by a decision or action taken under this part, by or on behalf of the Coast Guard, may appeal therefrom in accordance with subpart 1.03 of this chapter.
[CGD 88-033, 54 FR 50381, Dec. 6, 1989]
[[Page 25]]

Figure 1 to Part 150--Compatibility Chart
[GRAPHIC] [TIFF OMITTED] TC02FE91.079
Table I to Part 150--Alphabetical List of Cargoes

Chemical name	Group No.	Foot-note	CHRIS Code
Acetaldehyde	19		AAD
Acetic acid	4	2	AAC
Acetic anhydride	11		ACA
Acetochlor	10		ACG
Acetone	18	2	ACT
Acetone cyanohydrin	0	1, 2	ACY
Acetonitrile	37		ATN
Acetophenone	18		ACP
Acrolein	19	2	ARL
Acrylamide solution	10		AAM
Acrylic acid	4	2	ACR
Acrylonitrile	15	2	ACN
Acrylonitrile-Styrene copolymer dispersion in Polyether polyol.	20		ALE
Adiponitrile	37		ADN
Alachlor	33		ALH
Alcohols (C13+)	20		ALY
Including:			
Oleyl alcohol (octadecenol)			
Pentadecanol			
Tallow alcohol			
Tetradecanol			
Tridecanol			

Alcoholic beverages ..... 20 .....
Alcohol polyethoxylates 20
.....APU/APV/APW/AET
Alcohol polyethoxylates, secondary ..... 20 ..... AEA/AEB
Alkanes (C6-C9) ..... 31 1 ALK
Including: ....
Heptanes ....
Hexanes ....
Nonanes ....
Octanes ....
n-Alkanes (C10+) ..... 31 1 ALJ
Including: ....
Decanes ....
Dodecanes ....
Heptadecanes ....
Tridecanes ....
Undecanes ....
iso- & cyclo-Alkanes (C10-C11) ..... 31 1 AKI
iso- & cyclo-Alkanes (C12+)..... 31 1 AKJ
Alkane (C14-C17) sulfonic acid, sodium 34 ..... AKA
salt solution.
Alkaryl polyether (C9-C20) ..... 41 ..... AKP
Alkenyl(C11+)amide ..... 11 ..... AKM
Alkenyl(C16-C20)succinic anhydride ..... 11 ..... AAH
Alkyl acrylate-Vinyl pyridine copolymer in 32 2 AAP
Toluene.
Alkyl(C8+)amine, Alkenyl (C12+) acid ester 34 ..... AAA
mixture.
Alkylaryl phosphate mixtures (more than 34 ..... APD
40% Diphenyl tolyl phosphate, less than
0.02% ortho-isomer).
Alkyl(C3-C4)benzenes..... 32 2 AKC
Including: ....
Butylbenzenes ....
Cumene ....
Propylbenzenes ....
Alkyl(C5-C8)benzenes ..... 32 2 AKD
Including: ....
Amylbenzenes ....
Heptylbenzenes ....
Hexylbenzenes ....
Octylbenzenes ....
Alkyl(C9+)benzenes ..... 32 2 AKB
Including: ....
Decylbenzenes ....
Dodecylbenzenes ....
Nonylbenzenes ....
Tetradecylbenzenes ....
Tetrapropylbenzenes ....
Tridecylbenzenes ....
Undecylbenzenes ....
Alkylbenzene, Alkylindane, Alkylindene 32 2 AIH
mixture (each C12-C17).
Alkylbenzenesulfonic acid..... 0 1, 2 ABS/ABN
Alkylbenzenesulfonic acid, sodium salt 33 ..... ABT
solutions.
Alkyl dithiothiadiazole (C6-C24) ..... 33 ..... ADT
Alkyl ester copolymer (C4-C20) ..... 34 ..... AES
Alkyl(C7-C9) nitrates ..... 34 2 AKN
ONE
Alkyl(C7-C11) phenol poly(4-12)ethoxylate. 40 ..... APN

Alkyl(C8-C40) phenol sulfide ..... 34 ..... AKS
Alkyl(C8-C9) phenylamine in aromatic 9 ..... ALP
solvents.
Alkyl(C9-C15) phenyl propoxylate ..... 40 .....
Alkyl phthalates ..... 34 .....
Alkyl(C10-C20, saturated and unsaturated) 34 ..... AKL
phosphite.
Alkyl polyglucoside solutions..... 43 AGL/AGN/AGO/AGP/AGM
Alkyl sulfonic acid ester of phenol ..... 34 ....
Allyl alcohol ..... 15 2 ALA
Allyl chloride ..... 15 1 ALC
Aluminium chloride, Hydrochloric acid 0 1 AHS
solution.
Aluminum sulfate solution..... 43 2 ASX
ALM
2-(2-Aminoethoxy)ethanol..... 8 ..... AEX
Aminoethyldiethanolamine, 8 .....
Aminoethylethanolamine solution.
Aminoethylethanolamine..... 8 ..... AEE
N-Aminoethylpiperazine..... 7 ..... AEP
2-Amino-2-hydroxymethyl-1,3-propanediol 43 ..... AHL
solution.
2-Amino-2-methyl-1-propanol..... 8 ..... APQ
APR
Ammonia, anhydrous..... 6 ..... AMA
Ammonia, aqueous (28% or less Ammonia) 6 ..... AMH
(IMO cargo name), see Ammonium hydroxide.
Ammonium bisulfite solution..... 43 2 ABX
ASU
Ammonium hydrogen phosphate solution..... 0 1 AMI
Ammonium hydroxide (28% or less Ammonia).. 6 ..... AMH
Ammonium lignosulfonate solution, see also 43 .....
Lignin liquor.
Ammonium nitrate solution..... 0 1 ANR
AND/AMN
Ammonium nitrate, Urea solution 6 ..... UAS
(containing Ammonia).
Ammonium nitrate, Urea solution (not 43 ..... ANU
UAT
containing Ammonia).
Ammonium polyphosphate solution..... 43 ..... AMO
APP
Ammonium sulfate solution..... 43 ..... AME
AMS
Ammonium sulfide solution..... 5 ..... ASS
ASF
Ammonium thiocyanate, Ammonium thiosulfate 0 1 ACS
solution.
Ammonium thiosulfate solution..... 43 ..... ATV
ATF
Amyl acetate..... 34 ..... AEC
IAT/AML/AAS/AYA
Amyl alcohol..... 20 ..... AAI
IAA/AAN/ASE/APM
Amylene, see Pentene..... .... AMZ
PTX
tert-Amyl methyl ether (see also, Methyl 41 ..... AYE
tert-pentyl ether).
Amyl methyl ketone, see Methyl amyl ketone .... AMK
MAK
Aniline..... 9 ..... ANL

Animal and Fish oils, n.o.s.....	34	.....	AFN
Including:	.....	.....	
Cod liver oil	.....	.....	
Lanolin	.....	.....	
Neatsfoot oil	.....	.....	
Pilchard oil	.....	.....	
Sperm oil			
Animal and Fish acid oils and distillates, n.o.s..	34	.....	AFA
Including:	.....	.....	
Animal acid oil	.....	.....	
Fish acid oil	.....	.....	
Lard acid oil	.....	.....	
Mixed acid oil	.....	.....	
Mixed general acid oil	.....	.....	
Mixed hard acid oil	.....	.....	
Mixed soft acid oil	.....	.....	
Anthracene oil (Coal tar fraction), see COR	33	.....	AHO
Coal tar.			
Apple juice.....	43	.....	
Aryl polyolefin (C11-C50).....	30	.....	AYF
Asphalt..... ACU	33	.....	ASP
Asphalt blending stocks, roofers flux.....	33	.....	ARF
Asphalt blending stocks, straight run residue.	33	.....	ASR
Asphalt emulsion (ORIMULSION).....	33	.....	ASQ
Aviation alkylates..... GAV	33	.....	AVA
Barium long chain alkaryl(C11-C50) sulfonate.	34	.....	BCA
Barium long chain alkyl(C8-C14)phenate sulfide.	34	.....	BCH
Behenyl alcohol.....	20	.....	
Benzene.....	32	2	BNZ
Benzene hydrocarbon mixtures (having 10% Benzene or more). BHA	32	2	BHB
Benzenesulfonyl chloride.....	0	1, 2	BSC
Benzene, Toluene, Xylene mixtures.....	32	2	BTX
Benzene tricarboxylic acid, trioctyl ester	34	.....	
Benzylacetate.....	34	.....	BZE
Benzyl alcohol.....	21	.....	BAL
Benzyl chloride.....	36	.....	BCL
Brake fluid base mixtures.....	20	.....	BFX
Bromochloromethane.....	36	.....	BCM
Butadiene.....	30	.....	BDI
Butadiene, Butylene mixtures (cont. Acetylenes).	30	.....	BBM
Butane..... IBT/BUT	31	1	BMX
1,4-Butanediol, see Butylene glycol..... BUG	.....	.....	BDO
2-Butanone, see Methyl ethyl ketone.....	.....	.....	
Butene, see Butylene.....	.....	.....	IBL/BTN
Butene oligomer.....	30	.....	BOL
Butyl acetate..... IBA/BCN/BTA/BYA	34	.....	BAX

Butyl acrylate.....	14	1	BAR BAI/BTC
Butyl alcohol.....	20	2	BAY IAL/BAN/BAS/BAT
Butylamine.....	7	.....	BTY IAM/BAM/BTL/BUA
Butylbenzene, see Alky(C3-C4)benzenes.....	32	2	BBE AKC
Butyl benzyl phthalate.....	34	.....	BPH
Butyl butyrate.....	34	.....	BBA BUB/BIB
Butylene.....	30	.....	BTN IBL
Butylene glycol.....	20	2	BUG BDO
1,3-Butylene glycol, see Butylene glycol..	.....	.....	BUG
Butylene oxide.....	16	1	BTO
Butyl ether.....	41	.....	BTE
Butyl formate.....	34	.....	BFI/BFN
Butyl heptyl ketone.....	18	.....	BHK
Butyl methacrylate.....	14	1	BMH BMI/BMN
Butyl methacrylate, Decyl methacrylate, Cetyl-Eicosyl methacrylate mixture.	14	1	DER
Butyl methyl ketone, see Methyl butyl ketone.	.....	.....	MBK
Butyl phenol, Formaldehyde resin in Xylene	32	2	
n-Butyl propionate.....	34	.....	BPN
Butyl stearate.....	34	.....	
Butyl toluene.....	32	2	BUE
Butyraldehyde.....	19	.....	BAE BAD/BTR
Butyric acid.....	4	.....	BRA IBR
gamma-Butyrolactone.....	0	1, 2	BLA
C9 Resinfeed (DSM).....	32	2	CNR
Calcium alkyl(C9)phenol sulfide, polyolefin phosphorosulfide mixture.	34	.....	CPX
Calcium alkyl salicylate, see Calcium long chain alkyl salicylate (C13+).	.....	.....	CAK
Calcium bromide solution, see Drilling brines.	.....	.....	DRB
Calcium bromide, Zinc bromide solution, see Drilling brine (containing Zinc salts).	.....	.....	DZB
Calcium carbonate slurry.....	34	.....	

Calcium chloride solution.....	43	.....	CCS CLC
Calcium hydroxide slurry.....	5	.....	COH
Calcium hypochlorite solutions.....	5	.....	CHZ/CHU/CHY
Calcium lignosulfonate solution, see also Lignin liquor.	43	.....	
Calcium long chain alkaryl sulfonate (C11-C50).	34	.....	CAY
Calcium long chain alkyl phenates.....	34	.....	CAN/CAW
Calcium long chain alkyl phenate sulfide (C8-C40).	34	.....	CPI
Calcium long chain alkyl salicylate (C13+)	34	.....	CAK
Calcium long chain alkyl phenolic amine (C8-C40).	9	.....	CPQ

Calcium nitrate solution..... 34 ..... CNU
Calcium nitrate, Magnesium nitrate, 34 .....
Potassium chloride solution.
Calcium sulfonate, Calcium carbonate, 33 .....
Hydrocarbon solvent mixture.
Camphor oil..... 18 ..... CPO
Canola oil, see rapeseed oil under ``oils, ...
edible.''.
Caprolactam solution..... 22 ..... CLS
Caramel solutions..... 43 .....
Carbolic oil..... 21 ..... CBO
Carbon disulfide..... 38 ..... CBB
Carbon tetrachloride..... 36 2 CBT
Cashew nut shell oil (untreated)..... 4 ..... OCN
Catoxid feedstock..... 36 2 CXF
Caustic potash solution..... 5 2 CPS
Caustic soda solution..... 5 2 CSS
Cetyl alcohol (hexadecanol), see Alcohols .... ALY
(C13+).
Cetyl-Eicosyl methacrylate mixture..... 14 1 CEM
Cetyl-Stearyl alcohol, see Alcohols (C13+) .... ALY
Chlorinated paraffins (C10-C13)..... 36 ..... CLH
Chlorinated paraffins (C14-C17) (with 52% 36 ..... CLJ
Chlorine).
Chlorine..... 0 1 CLX
Chloroacetic acid solution..... 4 ..... CHM
CHL/MCA
Chlorobenzene..... 36 ..... CRB
Chlorodifluoromethane 36 ..... MCF
(monochlorodifluoromethane).
Chloroform..... 36 ..... CRF
Chlorohydrins..... 17 1 CHD
4-Chloro-2-methylphenoxyacetic acid, 9 ..... CDM
Dimethylamine salt solution.
Chloronitrobenzene..... 42 ..... CNO
1-(4-Chlorophenyl)-4,4-dimethyl pentan-3- 18 2 CDP
one.
Chloropropionic acid..... 4 ..... CPM
CLA/CLP
Chlorosulfonic acid..... 0 1 CSA
Chlorotoluene..... 36 ..... CHI
CTM/CTO/CRN
Choline chloride solutions..... 20 ..... CCO
28
Citric acid..... 4 ..... CIS
CIT
Clay slurry, see also Kaolin clay slurry.. 43 .....
Coal tar..... 33 ..... COR
OCT
Coal tar distillate..... 33 ..... CDL
Coal tar, high temperature..... 33 ..... CHH
Coal tar pitch..... 33 ..... CTP
Cobalt naphthenate in solvent naphtha..... 34 ..... CNS
Coconut oil, fatty acid..... 34 ..... CFA
Copper salt of long chain (C17+) alkanoic 34 ..... CUS
CFT
acid.
Corn syrup..... 43 ..... CSY
Cottonseed oil, fatty acid..... 34 ..... CFY
Creosote..... 21 2 CCT
CCW/CWD

Cresols..... 21 ..... CRS
CRL/CSL/CSO
Cresylate spent caustic..... 5 ..... CSC
Cresylic acid..... 21 ..... CRY
Cresylic acid, dephenolized..... 21 ..... CAD
Cresylic acid, sodium salt solution (IMO 5 ..... CSC
cargo name), see Cresylate spent caustic.
Cresylic acid tar..... 21 ..... CRX
Crotonaldehyde..... 19 2 CTA
Cumene (isopropyl benzene), see .... CUM
PBY
Propylbenzene.
1,5,9-Cyclododecatriene..... 30 ..... CYT
Cycloheptane..... 31 1 CYE
Cyclohexane..... 31 1 CHX
Cyclohexanol..... 20 ..... CHN
Cyclohexanone..... 18 ..... CCH
Cyclohexanone, Cyclohexanol mixtures..... 18 2 CYX
Cyclohexyl acetate..... 34 ..... CYC
Cyclohexylamine..... 7 ..... CHA
1,3-Cyclopentadiene dimer..... 30 ..... CPD
DPT
Cyclopentadiene, Styrene, Benzene mixture. 30 ..... CSB
Cyclopentane..... 31 1 CYP
Cyclopentene..... 30 ..... CPE
Cymene..... 32 2 CMP
Decahydronaphthalene..... 33 ..... DHN
Decaldehyde..... 19 ..... IDA/DAL
Decane, see n-Alkanes (C10+)..... .... DCC
ALJ
Decanoic acid..... 4 ..... DCO
Decene..... 30 ..... DCE
Decyl acetate..... 34 ..... DYA
Decyl acrylate..... 14 1 DAT
IAI/DAR
Decyl alcohol..... 20 2 DAX
ISA/DAN
Decylbenzene, see Alkyl(C9+) benzenes..... 32 2 DBZ
AKB
Decyloxytetrahydro-thiophene dioxide..... 0 1, 2 DHT
Degummed C9 (DOW)..... 33 ..... DGC
29
Dextrose solution, see Glucose solution... 43 ..... DTS
GLU
Diacetone alcohol..... 20 2 DAA
Dialkyl(C10-C14) benzenes, see Alkyl(C9+) 32 2 DAB
AKB
benzenes.
Dialkyl(C8-C9) diphenylamines..... 9 ..... DAQ
Dialkyl(C7-C13) phthalates..... 34 ..... DAH
Including: ....
Diisodecyl phthalate ....
Diisononyl phthalate ....
Dinonyl phthalate ....
Ditridecyl phthalate ....
Diundecyl phthalate ....
Dibromomethane..... 36 ..... DBH
Dibutylamine..... 7 ..... DBA
Dibutyl carbinol, see Nonyl alcohol..... .... NNS
Dibutyl hydrogen phosphonate..... 34 ..... DHD
Dibutylphenols..... 21 ..... DBT/DBV,

DBW
Dibutyl phthalate..... 34 ..... DPA
Dichlorobenzene..... 36 ..... DBX
DBM/DBO/DBP
3,4-Dichloro-1-butene..... 36 ..... DCD
DCB
Dichlorodifluoromethane..... 36 ..... DCF
1,1-Dichloroethane..... 36 ..... DCH
2,2'-Dichloroethyl ether..... 41 ..... DEE
1,6-Dichlorohexane..... 36 ..... DHX
2,2'-Dichloroisopropyl ether..... 36 ..... DCI
Dichloromethane..... 36 2 DCM
2,4-Dichlorophenol..... 21 ..... DCP
2,4-Dichlorophenoxyacetic acid, 43 ..... DDE
Diethanolamine salt solution.
2,4-Dichlorophenoxyacetic acid, 0 1, 2 DAD
DDA/DSX
Dimethylamine salt solution.
2,4-Dichlorophenoxyacetic acid, 43 2 DTI
Triisopropano-lamine salt solution.
Dichloropropane..... 36 ..... DPX
DPB/DPP/DPC/DPL
1,3-Dichloropropene..... 15 1 DPS
DPU/DPF
Dichloropropene, Dichloropropane mixtures. 15 1 DMX
2,2-Dichloropropionic acid..... 4 ..... DCN
Dicyclopentadiene, see also 1,3- 30 ..... DPT
CPD
Cyclopentadiene dimer.
Diethanolamine..... 8 ..... DEA
Diethanolamine salt of 2,4- .... DDE
Dichlorophenoxyacetic acid solution, see
2,4-Dichlorophenoxyacetic acid,
Diethanolamine salt solution.
Diethylamine..... 7 ..... DEN
Diethylaminoethanol (IMO cargo name), see 8 ..... DAE
Diethylethanolamine.
2,6-Diethylaniline..... 9 ..... DMN
Diethylbenzene..... 32 2 DEB
30
Diethylene glycol..... 40 2 DEG
Diethylene glycol butyl ether, see Poly(2- .... DME
PAG
8)alkylene glycol monoalkyl(C1-C6) ether.
Diethylene glycol butyl ether acetate, see .... DEM
PAF
Poly(2-8)alkylene glycol monoalkyl(C1-C6)
ether acetate.
Diethylene glycol dibenzoate..... 34 ..... DGZ
Diethylene glycol dibutyl ether..... 40 ..... DIG
Diethylene glycol diethyl ether..... 40 .....
Diethylene glycol ethyl ether, see Poly(2- .... DGE
PAG
8)alkylene glycol monoalkyl (C1-C6) ether.
Diethylene glycol ethyl ether acetate, see .... DGA
PAF
Poly(2-8)alkylene glycol monoalkyl(C1-C6)
ether acetates.
Diethylene glycol n-hexyl ether, see .... DHE
PAG
Poly(2-8)alkylene glycol monoalkyl(C1-C6)

ether.
Diethylene glycol methyl ether, see Poly(2- .... DGM
PAG
8)alkylene glycol monoalkyl(C1-C6) ether.
Diethylene glycol methyl ether acetate, ... DGR
PAF
see Poly(2-8)alkylene glycol monoalkyl(C1-
C6) ether acetate.
Diethylene glycol phenyl ether..... 40 ..... DGP
Diethylene glycol phthalate..... 34 ..... DGL
Diethylene glycol propyl ether, see Poly(2- .... DGO
PAG
8)alkylene glycol monoalkyl(C1-C6) ether.
Diethylenetriamine..... 7 2 DET
Diethylenetriamine pentaacetic acid, 43 .....
pentasodium salt solution.
Diethylethanolamine..... 8 ..... DAE
Diethyl ether (IMO cargo name), see Ethyl 41 ..... EET
ether.
Diethyl hexanol, see Decyl alcohol..... .... DAX
Di-(2-ethylhexyl)adipate..... 34 ..... DEH
Di-(2-ethylhexyl)phosphoric acid..... 1 1 DEP
Di-(2-ethylhexyl)phthalate, see Dioctyl 34 ..... DIE
DOP
phthalate.
Diethyl phthalate..... 34 ..... DPH
Diethyl sulfate..... 34 ..... DSU
Diglycidyl ether of Bisphenol A..... 41 ..... BDE
BPA
Diglycidyl ether of Bisphenol F..... 41 ..... DGF
Diheptyl phthalate..... 34 ..... DHP
Di-n-hexyl adipate..... 34 ..... DHA
Dihexyl phthalate..... 34 .....
1,4-Dihydro-9,10-dihydroxy anthracene, 5 ..... DDH
disodium salt solution.
Diisobutylamine..... 7 ..... DBU
31
Diisobutyl carbinol (commercial cargo 20 ..... DBC
NNS
name), see Nonyl alcohol.
Diisobutylene..... 30 ..... DBL
Diisobutyl ketone..... 18 ..... DIK
Diisobutyl phthalate..... 34 ..... DIT
Diisodecyl phthalate, see Dialkyl(C7-C13) .... DID
DAH
phthalates.
Diisononyl adipate..... 34 ..... DNY
Diisononyl phthalate, see Dialkyl(C7-C13) .... DIN
DAH
phthalates.
Diisooctyl phthalate..... 34 ..... DIO
Diisopropanolamine..... 8 ..... DIP
Diisopropylamine..... 7 ..... DIA
Diisopropylbenzene..... 32 2 DIX
Diisopropyl naphthalene..... 32 2 DII
N,N-Dimethylacetamide..... 10 ..... DAC
N,N-Dimethylacetamide solution..... 10 ..... DLS
Dimethyl adipate..... 34 ..... DLA
Dimethylamine..... 7 ..... DMA
Dimethylamine solution..... 7 ..... DMG/DMY/DMC
Dimethylamine salt of 4-Chloro-2- .... CDM

methylphenoxyacetic acid solution, see 4-
Chloro-2-methylphenoxyacetic acid,
Dimethylamine salt solution.
Dimethylamine salt of 2,4- ....
DAD/(DDA/DSX)
Dichlorophenoxyacetic acid solution, see
2,4-Dichlorophenoxyacetic acid,
Dimethylamine salt solution.
2,6-Dimethylaniline..... 9 ..... DMM
Dimethylbenzene, see Xylenes..... XLX
Dimethylcyclicsiloxane hydrolyzate..... 34 .....
N,N-Dimethylcyclohexylamine..... 7 ..... DXN
N,N-Dimethyldodecylamine (IMO cargo name), 7 ..... DDY
see Dodecyldimethylamine.
Dimethylethanolamine..... 8 ..... DMB
Dimethylformamide..... 10 ..... DMF
Dimethyl furan..... 41 .....
Dimethyl glutarate..... 34 ..... DGT
Dimethyl hydrogen phosphite..... 34 2 DPI
Dimethyl naphthalene sulfonic acid, sodium 34 2 DNS
salt solution.
Dimethyloctanoic acid..... 4 ..... DMO
Dimethyl phthalate..... 34 ..... DTL
Dimethylpolysiloxane, see 34 ..... DMP
Polydimethylsiloxane.
2,2-Dimethylpropane-1,3-diol..... 20 ..... DDI
Dimethyl succinate..... 34 ..... DSE
Dinitrotoluene..... 42 ..... DNM
DTT/DNL/DNU
Dinonyl phthalate, see Dialkyl(C7-C13) .... DIF
DAH
phthalates.
Dioctyl phthalate..... 34 ..... DOP
DIE
32
1,4-Dioxane..... 41 ..... DOX
Dipentene..... 30 ..... DPN
Diphenyl..... 32 2 DIL
Diphenylamine (molten)..... 9 ..... DAG
DAM/LRM
Diphenylamines, alkylated..... 7 ..... DAJ
Diphenylamine, reaction product with 2,2,4- 7 ..... DAK
trimethylpentene.
Diphenyl, Diphenyl ether mixture..... 33 ..... DDO
DTH
Diphenyl ether..... 41 ..... DPE
Diphenyl ether, Diphenyl phenyl ether 41 ..... DOB
mixture.
Diphenylmethane diisocyanate..... 12 ..... DPM
Diphenylol propane-Epichlorohydrin resins. 0 1 DPR
Diphenyl oxide, see as diphenyl ether..... ....
Di-n-propylamine..... 7 ..... DNA
Dipropylene glycol..... 40 ..... DPG
Dipropylene glycol butyl ether, see Poly(2- .... DBG
PAG
8)alkylene glycol monoalkyl(C1-C6) ether.
Dipropylene glycol dibenzoate..... 34 ..... DGY
Dipropylene glycol methyl ether, see Poly .... DPY
PAG
(2-8)alkylene glycol monoalkyl(C1-C6)
ether.

Distillates, flashed feed stocks..... 33 ..... DFF
Distillates, straight run..... 33 ..... DSR
Dithiocarbamate ester (C7-C35)..... 34 ..... DHO
Ditridecyl adipate..... 34 .....
Ditridecyl phthalate, see Dialkyl(C7-C13) .... DTP
DAH
phthalates.
Diundecyl phthalate, see Dialkyl(C7-C13) .... DUP
DAH
phthalates.
Dodecane..... 31 1 DOC
ALJ
tert-Dodecanethiol..... 0 2 DDL
Dodecanol..... 20 2 DDN
LAL
Dodecene..... 30 ..... DOZ
DDC/DOD
2-Dodecenylsuccinic acid, dipotassium salt 34 ..... DSP
solution.
Dodecyl alcohol (IMO cargo name), see .... DDN
Dodecanol.
Dodecylamine, Tetradecylamine mixture..... 7 2 DTA
Dodecylbenzene, see Alkyl(C9+)benzenes.... 32 2 DDB
AKB
Dodecylbenzenesulfonic acid..... 0 1, 2 DSA
Dodecyldimethylamine, 7 ..... DOT
Tetradecyldimethylamine mixture.
Dodecyl diphenyl ether disulfonate 43 ..... DOS
solution.
Dodecyl hydroxypropyl sulfide..... 0 1, 2 DOH
Dodecyl methacrylate..... 14 1 DDM
Dodecyl-Octadecyl methacrylate mixture.... 14 1 DOM
33
Dodecyl-Pentadecyl methacrylate mixtures.. 14 1 DDP
Dodecyl phenol..... 21 ..... DOL
Dodecyl xylene..... 32 2 DXY
Drilling brine (containing Calcium, 43 ..... DRB
Potassium or Sodium salts).
Drilling brine (containing Zinc salts).... 43 ..... DZB
Drilling mud (low toxicity) (if flammable 33 ..... DRM
or combustible).
Drilling mud (low toxicity) (if non- 43 ..... DRM
flammable or non-combustible).
Epichlorohydrin..... 17 1 EPC
Epoxy resin..... 18 .....
ETBE, see Ethyl tert-butyl ether..... .... EBE
Ethane..... 31 1 ETH
Ethanolamine (monoethanolamine)..... 8 ..... MEA
2-Ethoxyethanol, see Ethylene glycol .... EEO
EGC
monoalkyl ethers.
2-Ethoxyethyl acetate..... 34 ..... EEA
Ethoxylated alcohols, C11-C15, see the ....
alcohol poylethoxylates.
Ethoxylated long chain (C16+) 8 ..... ELA
alkyloxyalkanamine.
Ethoxy triglycol..... 40 ..... ETG
Ethyl acetate..... 34 ..... ETA
Ethyl acetoacetate..... 34 ..... EAA
Ethyl acrylate..... 14 1 EAC
Ethyl alcohol..... 20 2 EAL

Ethylamine..... 7 2 EAM
Ethylamine solution..... 7 ..... EAN
Ethyl amyl ketone..... 18 ..... EAK
ELK
Ethylbenzene..... 32 2 ETB
Ethyl butanol..... 20 ..... EBT
N-Ethyl-n-butylamine..... 7 ..... EBA
Ethyl tert-butyl ether..... 41 2 EBE
Ethyl butyrate..... 34 ..... EBR
Ethyl chloride..... 36 ..... ECL
Ethyl cyclohexane..... 31 1 ECY
N-Ethylcyclohexylamine..... 7 ..... ECC
Ethylene..... 30 ..... ETL
Ethyleneamine EA 1302..... 7 2 EMX
EDA
Ethylene carbonate..... 34 .....
Ethylene chlorohydrin..... 20 ..... ECH
Ethylene cyanohydrin..... 20 ..... ETC
Ethylenediamine..... 7 2 EDA
EMX
Ethylenediaminetetraacetic acid, 43 ..... EDS
tetrasodium salt solution.
Ethylene dibromide..... 36 ..... EDB
Ethylene dichloride..... 36 2 EDC
Ethylene glycol..... 20 2 EGL
Ethylene glycol acetate..... 34 ..... EGO
Ethylene glycol butyl ether, see Ethylene .... EGM
EGC
glycol monoalkyl ethers.
Ethylene glycol tert-butyl ether, see .... EGC
34
Ethylene glycol monoalkyl ethers.
Ethylene glycol butyl ether acetate..... 34 ..... EMA
Ethylene glycol diacetate..... 34 ..... EGY
Ethylene glycol dibutyl ether..... 40 ..... EGB
Ethylene glycol ethyl ether, see Ethyl .... EGE
EGC/EEO
glycol monoalkyl ethers.
Ethylene glycol ethyl ether acetate, see 2- .... EGA
EEA
Ethoxyethyl acetate.
Ethylene glycol hexyl ether..... 40 ..... EGH
Ethylene glycol isopropyl ether, see .... EGI
EGC
Ethylene glycol monoalkyl ethers.
Ethylene glycol methyl butyl ether, see 40 ..... EMB
EGC
Ethylene glycol monoalkyl ethers.
Ethylene glycol methyl ether, see Ethylene .... EME
EGC
glycol monoalkyl ethers.
Ethylene glycol methyl ether acetate..... 34 ..... EGT
.....
Ethylene glycol monoalkyl ethers..... 40 ..... EGC
Including: ....
Ethylene glycol butyl ether ....
Ethylene glycol isobutyl ether ....
Ethylene glycol tert-butyl ether ....
Ethylene glycol ethyl ether ....
Ethylene glycol hexyl ether ....
Ethylene glycol methyl ether ....

Ethylene glycol propyl ether ....
Ethylene glycol isopropyl ether ....
Ethylene glycol phenyl ether..... 40 ..... EPE
Ethylene glycol phenyl ether, Diethylene 40 ..... EDX
glycol phenyl ether mixture.
Ethylene glycol propyl ether, see Ethylene .... EGP
EGC
glycol monoalkyl ethers.
Ethylene glycol iso-propyl ether, see .... EGI
EGC
Ethylene glycol monoalkyl ethers.
Ethylene oxide..... 0 1 EOX
Ethylene oxide, Propylene oxide mixture... 16 1 EPM
Ethylene-Propylene copolymer..... 30 .....
Ethylene-Vinyl acetate copolymer emulsion. 43 .....
Ethyl ether..... 41 ..... EET
Ethyl-3-ethoxypropionate..... 34 ..... EEP
2-Ethylhexaldehyde, see Octyl aldehydes... .... HA
OAL
2-Ethylhexanoic acid, see Octanoic acids.. .... EHO
OAY
2-Ethylhexanol, see Octanol..... .... EHX
OCX
2-Ethylhexyl acrylate..... 14 1 EAI
2-Ethylhexylamine..... 7 ..... EHM
Ethyl hexyl phthalate..... 34 ..... EHE
Ethyl hexyl tallate..... 34 ..... EHT
2-Ethyl-1-(hydroxymethyl)propane-1,3-diol, 34 ..... EHD
C8-C10 ester.
Ethylidene norbornene..... 30 2 ENB
Ethyl methacrylate..... 14 1 ETM
N-Ethylmethylallylamine..... 7 ..... EML
2-Ethyl-6-methyl-N-(1'-methyl-2- 9 ..... EEM
methoxyethyl)aniline.
o-Ethyl phenol..... 21 ..... EPL
Ethyl propionate..... 34 ..... EPR
2-Ethyl-3-propylacrolein..... 19 2 EPA
Ethyl toluene..... 32 2 ETE
Fatty acids (saturated, C13+), see Fatty ....
acids (saturated, C14+).
Fatty acids (saturated, C14+)..... 34 ..... FAD
SRA
Ferric chloride solution..... 1 1 FCS
FCL
Ferric 43 2 FHX
STA
hydroxyethylethylenediaminetriacetic
acid, trisodium salt solution.
Ferric nitrate, Nitric acid solution..... 3 ..... FNN
Fish solubles (water based fish meal 43 ..... FSO
extracts).
Fluorosilicic acid..... 1 1 FSJ
Formaldehyde, Methanol mixtures..... 19 2 MTM
Formaldehyde solution..... 19 2 FMS
Formamide..... 10 ..... FAM
Formic acid..... 4 2 FMA
Fructose solution..... 43 .....
Fumaric adduct of Rosin, water dispersion. 43 ..... FAR
Furfural..... 19 ..... FFA
Furfuryl alcohol..... 20 2 FAL
Gas oil, cracked..... 33 ..... GOC

Gasoline blending stock, alkylates..... 33 ..... GAK
Gasoline blending stock, reformates..... 33 ..... GRF
Gasolines:
Automotive (not over 4.23 grams lead 33 ..... GAT
per gal.).
Aviation (not over 4.86 grams lead per 33 ..... GAV
AVA
gal).
Casinghead (natural)..... 33 ..... GCS
Polymer..... 33 ..... GPL
Straight run..... 33 ..... GSR
Glucose solution..... 43 ..... GLU
DTS
Glutaraldehyde solution..... 19 ..... GTA
Glycerine..... 20 2 GCR
Glycerine, Dioxanedimethanol mixture..... 20 ..... GDM
Glycerol monooleate..... 20 ..... GMO
Glycerol polyalkoxylate..... 34 .....
Glyceryl triacetate..... 34 .....
Glycidyl ester of C10 trialkyl acetic acid 34 ..... GLT
(IMO cargo name), see Glycidyl ester of
tridecyl acetic acid.
Gylcidyl ester of tridecylacetic acid..... 34 ..... GLT
Glycidyl ester of Versatic acid, see .... GLT
Gylcidyl ester of tridecylacetic acid.
36
Glycine, sodium salt solution..... 7 .....
Glycol diacetate, see Ethylene glycol .... EGY
diacetate.
Glycolic acid solution..... 4 ..... GLC
Glyoxal solutions..... 19 ..... GOS
Glyoxylic acid..... 4 ..... GAC
Glyphosate solution (not containing 7 ..... GIO
surfactant) (See also ROUNDUP).
Heptadecane, see n-Alkanes (C10+)..... .... ALJ
Heptane..... 31 1 HMX
ALK (HPI/HPT)
n-Heptanoic acid..... 4 ..... HEP
Heptanol..... 20 ..... HTX
HTN
Heptene..... 30 ..... HPX
HTE
Heptyl acetate..... 34 ..... HPE
Herbicide (C15-H22-NO2-Cl), see .... MCO
Metolachlor.
Hexadecanol (cetyl alcohol), see Alcohols .... ALY
(C13+).
1-Hexadecylnaphthalene, 1,4- 32 2
bis(Hexadecyl)naphthalene mixture.
Hexaethylene glycol, see Polyethylene ....
glycol.
Hexamethylene glycol..... 20 .....
Hexamethylenediamine..... 7 ..... HME
HMD/HMC
Hexamethylenediamine solution..... 7 ..... HMC
HMD/HME
Hexamethylenediamine adipate solution..... 43 ..... HAM
Hexamethylene diisocyanate..... 12 ..... HDI
Hexamethylenetetramine..... 7 ..... HMT
Hexamethylenetetramine solutions..... 7 ..... HTS
Hexamethylenimine..... 7 ..... HMI

Hexane..... 31 2 HXS
ALK (IHA/HXA)
Hexanoic acid..... 4 ..... HXO
Hexanol..... 20 ..... HXN
Hexene..... 30 ..... HEX
HXE/HXT/MPN/MTN
Hexyl acetate..... 34 ..... HAE
HSA
Hexylene glycol..... 20 ..... HXG
HiTec 321..... 7 ..... HIT
Hog grease, see Lard..... ....
Hydrochloric acid..... 1 1 HCL
Hydrofluorosilicic acid, see Fluorosilicic .... HFS
FSJ
acid.
bis(Hydrogenated tallow alkyl)methyl 7 ..... HTA
amines.
Hydrogen peroxide solutions..... 0 1 HPN/HPS/HPO
2-Hydroxyethyl acrylate..... 14 2 HAI
N-(Hydroxyethyl)ethylenediamine triacetic 43 ..... HET
FHX
acid, trisodium salt solution.
N,N-bis(2-Hydroxyethyl) oleamide..... 10 ..... HOO
37
2-Hydroxy-4-(methylthio)butanoic acid..... 4 ..... HBA
Hydroxy terminated polybutadiene (IMO 20 .....
cargo name), see Polybutadiene, hydroxy
terminated.
alpha-hydro-omega- .... HTO
Hydroxytetradeca(oxytetramethylene), see
Poly(tetramethylene ether) glycols (mw
950-1050).
Icosa(oxypropane-2,3-diyl)s..... 20 ..... IOP
Isophorone..... 18 2 IPH
Isophorone diamine..... 7 ..... IPI
Isophorone diisocyanate..... 12 ..... IPD
Isoprene..... 30 ..... IPR
Isoprene concentrate (Shell)..... 30 ..... ISC
Isopropylbenzene (cumene), see .... PBY
Propylbenzene.
Jet fuels:
JP-4..... 33 ..... JPF
JP-5..... 33 ..... JPV
JP-8..... 33 ..... JPE
Kaolin clay slurry..... 43 .....
Kerosene..... 33 ..... KRS
Ketone residue..... 18 ..... KTR
Kraft black liquor..... 5 ..... KPL
Kraft pulping liquors (Black, Green, or 5 ..... KPL
White).
Lactic acid..... 0 1, 2 LTA
Lactonitrile solution..... 37 ..... LNI
Lard..... 34 .....
Latex (ammonia inhibited)..... 30 ..... LTX
Latex, liquid synthetic..... 43 ..... LLS
LTX
Lauric acid..... 34 ..... LRA
Lauryl polyglucose, see Alkyl(C12 -C14) .... LAP
AGM
polyglucoside solution (55% or less).
Lecithin..... 34 ..... LEC

Lignin liquor..... 43 .....
Lignin sulfonic acid, sodium salt ....
solution, see Sodium lignosulfonate
solution.
d-Limonene, see Dipentene..... ....
Liquid Streptomyces solubles..... 43 .....
Long chain alkaryl polyether (C11-C20).... 41 ..... LCP
Long chain alkaryl sulfonic acid (C16-C60) 0 1, 2 LCS
Long chain alkylphenate/Phenol sulfide 21 ..... LPS
mixture.
Long chain polyetheramine in alkyl(C2- 7 ..... LCE
C4)benzenes.
l-Lysine solution..... 43 ..... LYS
Magnesium chloride solution..... 0 1, 2
Magnesium hydroxide slurry..... 5 .....
Magnesium long chain alkaryl sulfonate 34 ..... MAS
MSE
(C11-C50).
Magnesium long chain alkyl phenate sulfide 34 ..... MPS
(C8-C20).
Magnesium long chain alkyl salicylate 34 ..... MLS

(C11+).
Magnesium nonyl phenol sulfide, see .... MPS
Magnesium long chain alkyl phenate
sulfide (C8-C20).
Magnesium sulfonate, see Magnesium long .... MSE
MAS
chain alkaryl sulfonate (C11-C50).
Maleic anhydride..... 11 ..... MLA
Mercaptobenzothiazol, sodium salt solution 5 ..... SMB
(IMO cargo name), see Sodium-2-
mercaptobenzothiazol solution.
Mesityl oxide..... 18 2 MSO
Metam sodium solution..... 7 ..... MSS
SMD
Methacrylic acid..... 4 ..... MAD
Methacrylic resin in Ethylene dichloride.. 14 1 MRD
Methacrylonitrile..... 15 2 MET
Methane..... 31 1 MTH
3-Methoxy-1-butanol..... 20 .....
3-Methoxybutyl acetate..... 34 ..... MOA
N-(2-Methoxy-1-methyl ethyl)-2-ethyl-6- 34 ..... MCO
methyl chloroacetanilide (IMO cargo
name), see Metolachlor.
1-Methoxy-2-propyl acetate..... 34 ..... MPO
Methoxy triglycol..... 40 ..... MTG
Methyl acetate..... 34 ..... MTT
Methyl acetoacetate..... 34 ..... MAE
Methyl acetylene, Propadiene mixture..... 30 ..... MAP
Methyl acrylate..... 14 1 MAM
Methyl alcohol..... 20 2 MAL
Methylamine solutions..... 7 ..... MSZ
Methyl amyl acetate..... 34 ..... MAC
Methyl amyl alcohol..... 20 ..... MAA
MIC
Methyl amyl ketone..... 18 ..... MAK
Methyl bromide..... 36 ..... MTB
Methyl butanol, see the amyl alcohols..... .... AAI
Methyl butenol..... 20 ..... MBL
Methyl butenes (tert-amylenes), see .... PTX

Pentene.
Methyl tert-butyl ether..... 41 2 MBE
Methyl butyl ketone..... 18 2 MBK
Methylbutynol, see 2-Methyl-2-hydroxy-3- 20 ..... MBY
MHB
butyne.
3-Methyl butyraldehyde..... 19 .....
Methyl butyrate..... 34 ..... MBU
Methyl chloride..... 36 ..... MTC
Methylcyclohexane..... 31 1 MCY
Methylcyclopentadiene dimer..... 30 ..... MCK
Methyl diethanolamine..... 8 ..... MDE
MAB
Methylene chloride, see Dichloromethane... .... DCM
2-Methyl-6-ethylaniline..... 9 ..... MEN
Methyl ethyl ketone..... 18 2 MEK
2-Methyl-5-ethylpyridine..... 9 ..... MEP
Methyl formate..... 34 ..... MFM
N-Methylglucamine solution..... 43 ..... MGC
Methyl heptyl ketone..... 18 ..... MHK
2-Methyl-2-hydroxy-3-butyne..... 20 ..... MHB
Methyl isoamyl ketone..... 18 ..... MAK
Methyl isobutyl carbinol, see Methyl amyl .... MIC
MAA
alcohol.
Methyl isobutyl ketone..... 18 2 MIK
Methyl methacrylate..... 14 1 MMM
3-Methyl-3-methoxybutanol..... 20 .....
3-Methyl-3-methoxybutyl acetate..... 34 .....
Methyl naphthalene..... 32 2 MNA
Methylolureas..... 19 ..... MUS
2-Methyl pentane..... 31 1 IHA
2-Methyl-1-pentene, see Hexene..... .... MPN
HEX
4-Methyl-1-pentene, see Hexene..... .... MTN
HEX
Methyl tert-pentyl ether (IMO cargo name), 41 ..... AYE
see tert-Amyl methyl ether.
2-Methyl-1,3-propanediol..... 20 ..... MDL
Methyl propyl ketone..... 18 ..... MKE
Methylpyridine..... 9 ..... MPR/MPE/MPF
N-Methyl-2-pyrrolidone..... 9 2 MPY
Methyl salicylate..... 34 ..... MES
alpha-Methylstyrene..... 30 ..... MSR
3-(Methylthio)propionaldehyde..... 19 ..... MTP
Metolachlor..... 34 ..... MCO
Milk..... 43 .....
Mineral spirits..... 33 ..... MNS
Molasses..... 20 .....
Molasses residue..... 0 1
Monochlorodifluoromethane..... 36 ..... MCF
Monoethanolamine, see Ethanolamine..... ....
Monoisopropanolamine, see Propanolamine... ....
Morpholine..... 7 2 MPL
Motor fuel antiknock compounds containing 0 1 MFA
lead alkyls.
MTBE, see Methyl tert-butyl ether..... .... MBE
Myrcene..... 30 ..... MRE
Naphtha:Aromatic..... 33 .....
Coal tar solvent..... 33 ..... NCT
Heavy..... 33 .....

Paraffinic..... 33 .....
Petroleum..... 33 ..... PTN
Solvent..... 33 ..... NSV
Stoddard solvent..... 33 ..... NSS
Varnish Makers' and Painters'..... 33 ..... NVM
Naphthalene..... 32 2 NTM
Naphthalene still residue..... 32 2 NSR
Naphthalene sulfonic acid-formaldehyde 0 1 NFS
copolymer, sodium salt solution.
Naphthalene sulfonic acid, sodium salt 34 ..... NSA
solution.
Naphthenic acid..... 4 ..... NTI
Naphthenic acid, sodium salt solution..... 43 ..... NTS
Neodecanoic acid..... 4 ..... NEA
NIAX POLYOL APP 240C..... 0 1, 2 NXP
Nitrating acid..... 0 1 NIA
Nitric acid (70% or less)..... 3 ..... NCD
Nitric acid (greater than 70%)..... 0 1 NAC
Nitrobenzene..... 42 ..... NTB
o-Nitrochlorobenzene, see .... CNO
Chloronitrobenzene.
Nitroethane..... 42 ..... NTE
Nitroethane, 1-Nitropropane mixtures..... 42 ..... NNO
o-Nitrophenol..... 0 1, 2 NTP
NIP/NPH
Nitropropane..... 42 ..... NPM
NPN/NPP
Nitropropane, Nitroethane mixture..... 42 ..... NNO
(NNM/NNL)
Nitrotoluene..... 42 ..... NIT
NIE/NTT/NTR
Nonane..... 31 1 NAX
ALK (NAN)
Nonanoic acid..... 4 ..... NNA
NAI/NIN
Nonanoic, Tridecanoic acid mixture..... 4 ..... NAT
Nonene..... 30 ..... NOO
NON/NNE
Nonyl acetate..... 34 ..... NAE
Nonyl alcohol..... 20 2 NNS
NNI/NNN/DBC
Nonylbenzene, see Alkyl(C9+)benzenes..... .... AKB
Nonyl methacrylate..... 14 1 NMA
Nonyl phenol..... 21 ..... NNP
Nonyl phenol poly(4+)ethoxylates..... 40 ..... NPE
Nonyl phenol sulfide solution, see Alkyl .... AKS/NPS
phenol sulfide (C8-C40).
Noxious Liquid Substance, n.o.s. (NLS's).. 0 1
1-Octadecene, see the olefin or alpha- ....
olefin entries.
Octadecenoamide..... 10 ..... ODD
Octadecenol (oleyl alcohol), see Alcohols .... ALY
(C13+).
Octane..... 31 1 OAX
ALK (IOO/OAN)
Octanoic acid..... 4 ..... OAY
OAA/EHO
Octanol..... 20 2 OCX
IOA/OTA/EHX
Octene..... 30 ..... OTX
OTE

n-Octyl acetate..... 34 ..... OAF
OAE
Octyl alcohol, see Octanol..... .... OCX
Octyl aldehyde..... 19 ..... OAL
IOC/OLX/EHA
Octyl decyl adipate..... 34 ..... ODA
Octyl nitrate, see Alkyl(C7-C9) nitrates.. .... ONE
AKN
Octyl phenol..... 21 .....
Octyl phthalate, see Dioctyl phthalate.... .... DOP
Oil, edible:
Beechnut..... 34 ..... OBN
VEO
41
Castor..... 34 ..... OCA
VEO
Cocoa butter..... 34 ..... OCB
VEO
Coconut..... 34 2 OCC
VEO
Cod liver..... 34 ..... OCL
AFN
Corn..... 34 ..... OCO
VEO
Cottonseed..... 34 ..... OCS
VEO
Fish..... 34 2 OFS
AFN
Groundnut..... 34 ..... OGN
VEO
Hazelnut..... 34 ..... OHN
VEO
Lard..... 34 ..... OLD
AFN
Maize..... 34 ..... VEO (OCO)
Nutmeg butter..... 34 ..... ONB
VEO
Olive..... 34 ..... OOL
VEO
Palm..... 34 2 OPM
VEO
Palm kernel..... 34 ..... OPO
VEO
Peanut..... 34 ..... OPN
VEO
Poppy..... 34 ..... OPY
VEO
Poppy seed..... 34 ..... VEO
Raisin seed..... 34 ..... ORA
VEO
Rapeseed..... 34 ..... ORP
VEO
Rice bran..... 34 ..... ORB
VEO
Safflower..... 34 ..... OSF
VEO
Salad..... 34 ..... OSL
VEO
Sesame..... 34 ..... OSS
VEO
Soya bean..... 34 ..... OSB

VEO
Sunflower seed..... 34 ..... OSN
VEO
Tucum..... 34 ..... OTC
VEO
Vegetable..... 34 ..... OVG
VEO
Walnut..... 34 ..... OWN
VEO
Oil, fuel:
No. 1..... 33 ..... OON
42
No. 1-D..... 33 ..... OOD
No. 2..... 33 ..... OTW
No. 2-D..... 33 ..... OTD
No. 4..... 33 ..... OFR
No. 5..... 33 ..... OFV
No. 6..... 33 ..... OSX
Oil, misc:
Aliphatic..... 33 .....
Animal..... 34 ..... OMA
AFN
Aromatic..... 33 .....
Clarified..... 33 ..... OCF
Coal..... 33 .....
Coconut oil, fatty acid methyl ester.. 34 ..... OCM
Cotton seed oil, fatty acid..... 34 ..... CFY
Crude..... 33 ..... OIL
Diesel..... 33 ..... ODS
Gas, high pour..... 33 .....
Gas, low pour..... 33 .....
Gas, low sulfur..... 33 .....
Heartcut distillate..... 33 .....
Lanolin..... 34 ..... OLL
AFN
Linseed..... 33 ..... OLS
Lubricating..... 33 ..... OLB
Mineral..... 33 ..... OMN
Mineral seal..... 33 ..... OMS
Motor..... 33 ..... OMT
Neatsfoot..... 33 ..... ONF
AFN
Oiticica..... 34 ..... OOI
Palm oil, fatty acid methyl ester..... 34 ..... OPE
Penetrating..... 33 ..... OPT
Perilla..... 34 ..... OPR
Pilchard..... 34 ..... OPL
AFN
Pine..... 33 ..... OPI
PNL
Residual..... 33 .....
Road..... 33 ..... ORD
Rosin..... 33 ..... ORN
Seal..... 34 .....
Soapstock..... 34 ..... OIS
Soybean (epoxidized)..... 34 ..... EVO
Sperm..... 33 ..... OSP
AFN
Spindle..... 33 ..... OSD
Tall..... 34 ..... OTL
Tall, fatty acid..... 34 2 TOF

Transformer..... 33 ..... OTF
Tung..... 34 ..... OTG
Turbine..... 33 ..... OTB
Wood..... 34 .....
Olefin/Alkyl ester copolymer (molecular 34 ..... OCP
weight 2000+).
Olefin mixtures..... 30 ..... OFX/OFY
alpha-Olefins (C6-C18) mixtures..... 30 ..... OAM
Olefins (C13+)..... 30 .....
43
Oleic acid..... 34 ..... OLA
Oleum..... 0 1, 2 OLM
Oleyl alcohol (octadecenol), see Alcohols .... ALY
(C13+).
Oleylamine..... 10 ..... OLY
ORIMULSION, see Asphalt emulsion..... .... ASQ
Oxyalkylated alkyl phenol formaldehyde.... 33 .....
Palm kernel acid oil..... 34 ..... PNO
Palm kernel acid oil, methyl ester..... 34 ..... PNF
Palm kernel oil, fatty acid, see Palm .... PNO
kernel acid oil.
Palm kernel oil, fatty acid methyl ester, ... PNF
see Palm kernel acid oil, methyl ester.
Palm stearin..... 34 ..... PMS
n-Paraffins (C10-C20), see n-Alkanes .... PFN
ALJ
(C10+).
Paraldehyde..... 19 ..... PDH
Paraldehyde-Ammonia reaction product..... 9 ..... PRB
Pentachloroethane..... 36 ..... PCE
Pentacosa(oxypropane-2,3-diyl)s..... 20 ..... POY
Pentadecanol, see Alcohols (C13+)..... .... PDC
ALY
1,3-Pentadiene..... 30 ..... PDE
PDN
Pentaethylene glycol, see Polyethylene ....
glycols.
Pentaethylene glycol methyl ether, see .... PAG
Poly(2-8)alkylene glycol monoalkyl(C1-C6)
ether.
Pentaethylenehexamine..... 7 ..... PEN
Pentaethylenehexamine, 7 ..... PEP
Tetraethylenepentamine mixture.
Pentane..... 31 1 PTY
IPT/PTA
Pentanoic acid..... 4 ..... POC
n-Pentanoic acid, 2-Methyl butryic acid 4 ..... POJ
POC
mixture.
Pentasodium salt of Diethylenetriamine ....
pentaacetic acid solution, see
Diethylenetriamine pentaacetic acid,
pentasodium salt solution.
Pentene..... 30 ..... PTX
PTE
Pentyl aldehyde..... 19 .....
n-Pentyl propionate..... 34 ..... PPE
Perchloroethylene..... 36 2 PER
TTE
Petrolatum..... 33 ..... PTL
Phenol..... 21 ..... PHN

1-Phenyl-1-xylyl ethane..... 32 2 PXE
Phosphate esters, alkyl(C12-C14)amine..... 7 ..... PEA
Phosphoric acid..... 1 1 PAC
Phosphorus..... 0 1 PPW
PPR/PPB
Phthalate based polyester polyol..... 0 1, 2 PBE
Phthalic anhydride..... 11 ..... PAN
44
alpha-Pinene..... 30 ..... PIO
PIN
beta-Pinene..... 30 ..... PIP
PIN
Pine oil..... 33 ..... PNL
OPI
Polyalkyl(C18-C22) acrylate in Xylene..... 14 1 PIX
Polyalkylene glycol butyl ether, see .... PGB
PAG
Poly(2-8)alkylene glycol monoalkyl(C1-C6)
ether.
Poly(2-8)alkylene glycol monoalkyl(C1-C6) 40 ..... PAG
ether.
Including: ....
Diethylene glycol butyl ether ....
Diethylene glycol ethyl ether ....
Diethylene glycol n-hexyl ether ....
Diethylene glycol methyl ether ....
Diethylene glycol n-propyl ether ....
Dipropylene glycol butyl ether ....
Dipropylene glycol methyl ether ....
Polyalkylene glycol butyl ether ....
Polyethylene glycol monoalkyl ether ....
Polypropylene glycol methyl ether ....
Tetraethylene glycol methyl ether ....
Triethylene glycol butyl ether ....
Triethylene glycol ethyl ether ....
Triethylene glycol methyl ether ....
Tripropylene glycol methyl ether ....
Poly(2-8)alkylene glycol monoalkyl(C1-C6) 34 ..... PAF
ether acetate.
Including: ....
Diethylene glycol butyl ether acetate ....
Diethylene glycol ethyl ether acetate ....
Diethylene glycol methyl ether acetate ....
Polyalkylene glycols, Polyalkylene glycol 40 ..... PPX
monoalkyl ethers mixtures.
Polyalkylene oxide polyol..... 20 ..... PAO
Polyalkyl methacrylate (C1-C20)..... ....
Polyalkyl(C10-C20)methacrylate..... 14 1 PMT
Polyalkyl(C10-C18)methacrylate/Ethylene 14 1 PEM
propylene copolymer mixture.
Polyaluminum chloride solution..... 1 1
Polybutadiene, hydroxyl terminated..... 20 .....
Polybutene..... 30 ..... PLB
Polybutenyl succinimide..... 10 ..... PBS
Poly(2+)cyclic aromatics..... 32 2 PCA
Polydimethylsiloxane..... 34 .....
Polyether (molecular weight 2000+)..... 41 ..... PYR
Polyethylene glycol..... 40 .....
Polyethylene glycol dimethyl ether..... 40 .....
Polyethylene glycol monoalkyl ether, see .... PEE
PAG

Poly(2-8)alkylene glycol monoalkyl(C1-C6)
ether.
Polyethylene polyamines..... 7 2 PEB
Polyferric sulfate solution..... 34 ..... PSS
Polyglycerine, Sodium salts solution 20 2 PGT
45
(containing less than 3% Sodium
hydroxide).
Polyglycerol..... 20 ..... GCR
Polyisobutenamine in aliphatic (C10-C14) 7 ..... PIB
solvent.
Polyisobutenyl anhydride adduct..... 11 .....
Poly(4+)isobutylene..... 30 .....
Polymethylene polyphenyl isocyanate..... 12 ..... PPI
Polymethylsiloxane..... 34 .....
Polyolefin (molecular weight 300+)..... 30 .....
Polyolefin amide alkeneamine (C17+)..... 33 ..... POH
Polyolefin amide alkeneamine (C28+)..... 33 ..... POD
Polyolefin amide alkeneamine borate (C28- 33 ..... PAB
C250).
Polyolefin amide alkeneamine/Molybdenum 7 .....
oxysulfide mixture.
Polyolefin amide alkeneamine polyol..... 20 ..... PAP
Poly(C17+)olefin amine..... 7 ..... POG
Polyolefinamine (C28-C250)..... 33 ..... POM
Polyolefinamine in alkyl(C2-C4)benzenes... 32 2 POF
Polyolefin aminoester salt..... 34 ..... PAE
Polyolefin anhydride..... 11 ..... PAR
Polyolefin ester (C28-C250)..... 34 ..... POS
Polyolefin phenolic amine (C28-C250)..... 7 ..... PPH
Polyolefin phosphorosulfide, barium 34 ..... PPS
derivative (C28-C250).
Poly(20)oxyethylene sorbitan monooleate... 34 ..... PSM
Poly(5+)propylene..... 30 ..... PLQ
PLP
Polypropylene glycol..... 40 ..... PGC
Polypropylene glycol methyl ether, see .... PGM
PGE
Propylene glycol monoalkyl ether.
Polysiloxane..... 34 ..... DMP
Poly(tetramethylene ether) glycols (mw 950- 40 ..... HTO
1050) (alpha-hydro-omega-
Hydroxytetradeca(oxytetramethylene)).
Polytetramethylene ether glycol..... 40 .....
Potassium chloride solution..... 43 ..... PCS
(DRB)
Potassium formate solution..... 34 ..... PFR
Potassium hydroxide solution (IMO cargo 5 2 CPS
name), see Caustic potash solution.
Potassium oleate..... 34 ..... POE
Potassium salt of polyolefin acid..... 34 .....
Potassium thiosulfate solution..... 43 ..... PTF
Propane..... 31 1 PRP
Propanolamine..... 8 ..... PAX
MPA/PLA
Propionaldehyde..... 19 ..... PAD
Propionic acid..... 4 ..... PNA
Propionic anhydride..... 11 ..... PAH
Propionitrile..... 37 ..... PCN
n-Propoxypropanol, see Propylene glycol .... PXP
PGE

monoalkyl ether.
Propyl acetate..... 34 ..... IAC/PAT
Propyl alcohol..... 20 2 IPA/PAL
46
Propylamine..... 7 ..... IPP/PRA
iso-Propylamine solution..... 7 ..... IPO/IPQ
Propylbenzene..... 32 2 PBY
PBZ/CUM
n-Propyl chloride..... 36 ..... PRC
iso-Propylcyclohexane..... 31 1 IPX
Propylene..... 30 ..... PPL
Propylene-butylene copolymer..... 30 ..... PBP
Propylene carbonate..... 34 .....
Propylene dimer..... 30 ..... PDR
Propylene glycol..... 20 2 PPG
Propylene glycol n-butyl ether, see .... PGD
PGE
Propylene glycol monoalkyl ether.
Propylene glycol ethyl ether, see .... PGY
PGE
Propylene glycol monoalkyl ether.
Propylene glycol methyl ether, see .... PME
PGE
Propylene glycol monoalkyl ether.
Propylene glycol methyl ether acetate..... 34 ..... PGN
Propylene glycol monoalkyl ether..... 40 ..... PGE
Including: ....
n-Propoxypropanol ....
Propylene glycol n-butyl ether ....
Propylene glycol ethyl ether ....
Propylene glycol methyl ether ....
Propylene glycol propyl ether ....
Propylene glycol phenyl ether..... 40 ..... PGP
Propylene glycol propyl ether, see .... PGE
Propylene glycol monoalkyl ether.
Propylene oxide..... 16 1 POX
Propylene, Propane, MAPP gas mixture..... 30 2 PPM
Propylene tetramer..... 30 ..... PTT
Propylene trimer..... 30 ..... PTR
Propyl ether..... 41 ..... IPE/PRE
Pseudocumene, see Trimethylbenzene..... .... TME/TRE
Pyridine..... 9 ..... PRD
Pyridine bases, see Paraldehyde-Ammonia .... PRB
reaction product.
Roehm monomer 6615..... 14 1 RMN
Rosin oil..... 33 ..... ORN
Rosin soap (disproportionated) solution... 43 ..... RSP
ROUNDUP (See also Glyphosate solution).... 7 ..... RUP
Rum, see Alcoholic beverages..... ....
SAP 7001..... 0 1 SON
Sewage sludge..... 43 .....
Silica slurry..... 43 .....
Sludge, treated..... 43 .....
Sodium acetate, Glycol, Water mixture (not 34 2 SAO
SAP
containing Sodium hydroxide).
Sodium acetate, Glycol, Water mixture 5 ..... SAP
SAO
(containing Sodium hydroxide).
Sodium acetate solution..... 34 ..... SAN
AKP

Sodium alkyl sulfonate solution..... 43 ..... SSU
47
Sodium alkyl (C14-C17) sulfonates 60-65% 34 ..... AKA
solution (IMO cargo name), see Alkane
(C14-C17) sulfonic acid, sodium salt
solution.
Sodium aluminate solution..... 5 ..... SAU
Sodium aluminosillicate slurry..... 34 .....
Sodium benzoate solution..... 34 ..... SBN
Sodium borohydride, Sodium hydroxide 5 ..... SBX
SBH/SBI
solution.
Sodium carbonate solutions..... 5 ..... SCE
Sodium chlorate solution..... 0 1, 2 SDD
SDC
Sodium cyanide solution..... 5 ..... SCS
SCN
Sodium dichromate solution..... 0 1, 2 SDL
SCR
Sodium dimethyl naphthalene sulfonate .... DNS
solution, see Dimethyl naphthalene
sulfonic acid, sodium salt solution.
Sodium hydrogen sulfide, Sodium carbonate 0 1, 2 SSS
solution.
Sodium hydrogen sulfite solution..... 43 ..... SHX
Sodium hydrosulfide solution..... 5 2 SHR
Sodium hydrosulfide, Ammonium sulfide 5 2 SSA
solution.
Sodium hydroxide solution (IMO cargo 5 2 CSS
name), see Caustic soda solution.
Sodium hypochlorite solution..... 5 .....
SHP/SHQ/(SHC)
Sodium lignosulfonate solution, see also 43 .....
Lignin liquor.
Sodium long chain alkyl salicylate (C13+). 34 ..... SLS
Sodium 2-mercaptobenzothiazol solution.... 5 ..... SMB
Sodium N-methyl dithio carbamate solution, ... MSS
see Metam sodium solution.
Sodium naphthalene sulfonate solution, see .... SNS
NSA
Naphthalene sulfonic acid, sodium salt
solution.
Sodium naphthenate solution, see .... NTS
Naphthenic acid, sodium salt solution.
Sodium nitrite solution..... 5 ..... SNI
SNT
Sodium petroleum sulfonate..... 33 ..... SPS
Sodium polyacrylate solution..... 43 2
Sodium salt of Ferric .... STA
FHX
hydroxyethylethylenediaminetriacetic acid
solution, see Ferric
hydroxyethylethylenediaminetriacetic
acid, trisodium salt solution.
Sodium silicate solution..... 43 2 SSN
SSC
Sodium sulfide, Hydrosulfide solution..... 0 1, 2 SSH/SSI/SSJ
Sodium sulfide solution..... 43 ..... SDR
Sodium sulfite solution..... 43 ..... SUP
SUS
48

Sodium tartrates, Sodium succinates 43 ..... STM
solution.
Sodium thiocyanate solution..... 0 1, 2 STS
SCY
Sorbitol solutions..... 20 ..... SBT
Soyabean oil (expoxidized)..... 34 ..... OSC/EVO
Stearic acid, see Fatty acids (saturated, ... SRA
FAD
C14+).
Stearyl alcohol..... 20 .....
Styrene..... 30 ..... STY
STX
Sulfohydrocarbon (C3-C88)..... 33 ..... SFO
Sulfohydrocarbon, long chain (C18+) 7 ..... SFX
alkylamine mixture.
Sulfolane..... 39 ..... SFL
Sulfonated polyacrylate solutions..... 43 2
Sulfur..... 0 1 SXX
Sulfuric acid..... 2 2 SFA
Sulfuric acid, spent..... 2 2 SAC
Sulfurized fat (C14-C20)..... 33 ..... SFT
Sulfurized polyolefinamide alkene(C28- 33 ..... SPO
C250) amine.
Tall oil..... 34 ..... OTL
Tall oil fatty acid (Resin acids less than 34 2 TOF
20%).
Tall oil fatty acid, barium salt..... 0 1, 2 TOB
Tall oil soap (disproportionated) solution 43 ..... TOS
Tallow..... 34 2 TLO
Tallow fatty acid..... 34 2 TFD
Tallow fatty alcohol, see Alcohols (C13+). .... TFA
ALY
Tallow nitrile..... 37 ..... TAN
TAME, see tert-Amyl methyl ether..... .... AYE
1,1,2,2-Tetrachloroethane..... 36 ..... TEC
Tetrachloroethylene, see Perchloroethylene .... TTE
PER
Tetradecanol, see Alcohols (C13+)..... .... TTN
ALY
Tetradecene, see the olefins entries..... .... TTD
Tetradecylbenzene, see Alkyl(C9+) benzenes 32 2 TDB
AKB
Tetraethylene glycol..... 40 ..... TTG
Tetraethylene glycol methyl ether, see .... PAG
Poly(2-8)alkylene glycol monoalkyl(C1-C6)
ether.
Tetraethylenepentamine..... 7 2 TTP
Tetrahydrofuran..... 41 ..... THF
Tetrahydronaphthalene..... 32 2 THN
1,2,3,5-Tetramethylbenzene, see .... TTB
TTC
Tetramethylbenzene.
Tetramethylbenzene..... 32 2 TTC
TTB
Tetrapropylbenzene, see Alkyl(C9+)benzenes .... AKB
Tetrasodium salt of EDTA solution, see .... EDS
Ethylenediaminetetraacetic acid,
tetrasodium salt solution.

Titanium dioxide slurry..... 43 ..... TDS
Titanium tetrachloride..... 2 2 TTT

Toluene..... 32 2 TOL
Toluenediamine..... 9 ..... TDA
Toluene diisocyanate..... 12 ..... TDI
o-Toluidine..... 9 ..... TLI
Triarylphosphate, see Triisopropylated .... TRA
TPL
phenyl phosphates.
Tributyl phosphate..... 34 ..... TBP
1,2,4-Trichlorobenzene..... 36 ..... TCB
1,1,1-Trichloroethane..... 36 2 TCE
1,1,2-Trichloroethane..... 36 ..... TCM
Trichloroethylene..... 36 2 TCL
1,2,3-Trichloropropane..... 36 2 TCN
1,1,2-Trichloro-1,2,2-trifluoroethane..... 36 ..... TTF
Tricresyl phosphate..... 34 ..... TCO/TCP
Tridecane, see n-Alkanes (C10+)..... .... TRD
ALJ
Tridecanoic acid..... 34 ..... TDO
Tridecanol, see Alcohols (C13+)..... .... TDN
ALY
Tridecene, see Olefins (C13+)..... .... TDC
Tridecyl acetate..... 34 ..... TAE
Tridecylbenzene, see Alkyl(C9+) benzenes.. 32 2 TRB
AKB
Triethanolamine..... 8 2 TEA
Triethylamine..... 7 ..... TEN
Triethylbenzene..... 32 2 TEB
Triethylene glycol..... 40 ..... TEG
Triethylene glycol butyl ether, see Poly(2- .... PAG
8)alkylene glycol monoalkyl(C1-C6) ether.
Triethylene glycol butyl ether mixture.... 40 .....
Triethylene glycol dibenzoate..... 34 ..... TGB
Triethylene glycol di-(2-ethylbutyrate)... 34 ..... TGD
Triethylene glycol ether mixture..... 40 .....
Triethylene glycol ethyl ether, see Poly(2- .... TGE
PAG
8)alkylene glycol monoalkyl(C1-C6) ether.
Triethylene glycol methyl ether, see .... TGY
PAG
Poly(2-8)alkylene glycol monoalkyl(C1-C6)
ether.
Triethylenetetramine..... 7 2 TET
Triethyl phosphate..... 34 ..... TPS
Triethyl phosphite..... 34 2 TPI
Triisobutylene..... 30 ..... TIB
Triisooctyl trimellitate..... 34 .....
Triisopropanolamine..... 8 ..... TIP
Triisopropanolamine salt of 2,4- .... DTI
Dichlorophenoxyacetic acid solution, see
2,4-Dichlorophenoxyacetic acid,
Triisopropanolamine salt solution.
Triisopropylated phenyl phosphates..... 34 ..... TPL
Trimethylacetic acid..... 4 ..... TAA
Trimethylamine solution..... 7 ..... TMT
Trimethylbenzene..... 32 2 TRE
TME/TMB/TMD

Trimethylhexamethylenediamine (2,2,4- and 7 ..... THA
2,4,4-).
Trimethylhexamethylene diisocyanate (2,2,4- 12 ..... THI
and 2,4,4-).

Trimethyl nonanol, see Dodecanol..... .... DDN
Trimethylol propane polyethoxylate..... 20 ..... TPR
2,2,4-Trimethyl-1,3-pentanediol 34 ..... TMQ
diisobutyrate.
2,2,4-Trimethyl-1,3-pentanediol-1- 34 ..... TMP
isobutyrate.
2,2,4-Trimethyl-3-pentanol-1-isobutyrate.. 34 .....
Trimethyl phosphite..... 34 2 TPP
1,3,5-Trioxane..... 41 2 TRO
Triphenylborane, Caustic soda solution.... 5 ..... TPB
Tripropylene, see Propylene trimer..... .... PTR
Tripropylene glycol..... 40 ..... TGC
Tripropylene glycol methyl ether, see .... TGM
PAG
Poly(2-8)alkylene glycol monoalkyl(C1-C6)
ether.
Trisodium nitrilotriacetate..... 34 .....
Trisodium phosphate solution..... 5 ..... TSP
Trisodium salt of N- .... HET
(Hydroxyethyl)ethylenediaminetriacetic
acid solution, see N-
(Hydroxyethyl)ethylenediaminetriacetic
acid, trisodium salt solution.
Trixylyl phosphate (IMO cargo name), see 34 ..... TRP
Trixylenyl phosphate.
Trixylenyl phosphate..... 34 ..... TRP
Turpentine..... 30 ..... TPT
Ucarsol CR Solvent 302 SG..... 8 ..... UCS
Undecanoic acid..... 4 ..... UDA
Undecanol, see Undecyl alcohol..... .... UND
Undecene..... 30 ..... UDC
Undecyl alcohol..... 20 ..... UND
Undecylbenzene, see Alkyl(C9+) benzenes... .... UDB
AKB
Urea, Ammonium mono- and di-hydrogen 0 1 UPX
phosphate, Potassium chloride solution.
Urea, Ammonium nitrate solution 6 ..... UAS
(containing Ammonia).
Urea, Ammonium nitrate solution (not 43 ..... UAT
ANU
containing Ammonia).
Urea, Ammonium phosphate solution..... 43 ..... UAP
Urea solution..... 43 ..... URE
Valeraldehyde..... 19 ..... VAK
IVA/VAL
Vanillin black liquor..... 5 ..... VBL
Vegetable oils, n.o.s..... 34 ..... VEO
Including: ....
Beechnut oil ....
Castor oil ....
Cocoa butter ....
Coconut oil ....
Corn oil ....
Cottonseed oil ....

Groundnut oil ....
Hazelnut oil ....
Linseed oil ....
Nutmeg butter ....
Oiticica oil ....
Olive oil ....

Palm kernel oil ....
Palm oil ....
Peel oil (oranges and lemons) ....
Perilla oil ....
Poppy oil ....
Raisin seed oil ....
Rapeseed oil ....
Rice bran oil ....
Safflower oil ....
Salad oil ....
Sesame oil ....
Soya bean oil ....
Sunflower seed oil ....
Tucum oil ....
Tung oil ....
Walnut oil ....
Vegetable acid oils and distillates, 34 ..... VAO
n.o.s..
Including: ....
Corn acid oil ....
Cottonseed acid oil ....
Dark mixed acid oil ....
Groundnut acid oil ....
Mixed acid oil ....
Mixed general acid oil ....
Mixed hard acid oil ....
Mixed soft acid oil ....
Rapeseed acid oil ....
Safflower acid oil ....
Soya acid oil ....
Sunflower seed acid oil ....
Vegetable protein solution..... 43 .....
Vinyl acetate..... 13 1 VAM
Vinyl chloride..... 35 ..... VCM
.Vinyl ethyl ether..... 13 1 VEE
Vinylidene chloride..... 35 VCI
Vinyl neodecanate..... 13 1 VND
Vinyltoluene..... 13 1 VNT
Water..... 43 .....
Waxes:..... .... WAX
Candelilla..... 34 ..... WDC
Carnauba..... 34 ..... WCA
Paraffin..... 31 1 WPF
Petroleum..... 33 .....
Wine, see Alcoholic beverages..... ....
White spirit (low (15-20%) aromatic)..... 33 ..... WSL
WSP
Xylene..... 32 2 XLX
XLM/XLO/XLP
Xylenes, Ethylbenzene mixture..... 32 2 XEB
Xylenols..... 21 ..... XYL
Zinc alkaryl dithiophosphate (C7-C16)..... 34 ..... ZAD
52
Zinc alkenyl carboxamide..... 10 ..... ZAA
Zinc alkyl dithiophosphate (C3-C14)..... 34 ..... ZAP
Zinc bromide, Calcium bromide solution, ... DZB
see Drilling brine (containing Zinc
salts).
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1. Because of very high reactivity or unusual conditions of carriage or

potential compatibility problems, this
commodity is not assigned to a specific group in the Compatibility
Chart. For additional compatibility
information, contact Commandant (G-MSO), U.S. Coast Guard, 2100 Second
Street, SW., Washington, DC 20593-0001.
Telephone (202) 267-1577.
2. See Appendix I--Exceptions to the Chart.
[USCG 2000-7079, 65 FR 67162, Nov. 8, 2000]
Table II to Part 150--Grouping of Cargoes
0. Unassigned Cargoes
Acetone cyanohydrin [1, 2]
Alkylbenzenesulfonic acid [1, 2]
Aluminium chloride, Hydrochloric acid solution [1]
Ammonium hydrogen phosphate solution [1]
Ammonium nitrate solution [1]
Ammonium thiocyanate, Ammonium thiosulfate solution [1]
Benzenesulfonyl chloride [1, 2]
gamma-Butyrolactone [1, 2]
Chlorine [1]
Chlorosulfonic acid [1]
Decyloxytetrahydro-thiophene dioxide [2]
tert-Dodecanethiol [2]
2,4-Dichlorophenoxyacetic acid, Dimethylamine salt solution
[1, 2]
Dimethylamine salt of 2,4-Dichlorophenoxyacetic acid solution
[1, 2]
Diphenylol propane-Epichlorohydrin resins [1]
Dodecylbenzenesulfonic acid [1, 2]
Dodecyl hydroxypropyl sulfide [2]
Ethylene oxide [1]
Fluorosilicic acid
Hydrogen peroxide solutions [1]
Lactic acid [2]
Long chain alkaryl sulfonic acid (C16-C60) [2]
Magnesium chloride solution [1, 2]
Molasses residue [1]
Motor fuel antiknock compounds containing Lead alkyls [1]
Naphthalene sulfonic acid-formaldehyde copolymer, sodium salt
solution [1]
NIAX POLYOL APP 240C [1, 2]
Nitrating acid [1]
Nitric acid (greater than 70%) [1]
o-Nitrophenol [1, 2]
Noxious Liquid Substance, n.o.s. (NLS's) [1]
Oleum [1, 2]

Phosphorus [1]
Phthalate based polyester polyol [2]
SAP 7001 [1]
Sodium chlorate solution [1, 2]
Sodium dichromate solution [1, 2]
Sodium hydrogen sulfide, Sodium carbonate solution [1, 2]
Sodium sulfide, Hydrosulfide solution [1, 2]
Sodium thiocyanate solution [1, 2]
Sulfur [1]
Tall oil fatty acid, barium salt [2]
Urea, Ammonium mono- and di-hydrogen phosphate, Potassium chloride
solution
1. Non-Oxidizing Mineral Acids
Di-(2-ethylhexyl)phosphoric acid
Ferric chloride solution
Fluorosilicic acid

Hydrochloric acid
Phosphoric acid
Polyaluminum chloride solution
2. Sulfuric Acids
Sulfuric acid 2
Sulfuric acid, spent
Titanium tetrachloride
3. Nitric Acid
Ferric nitrate, Nitric acid solution
Nitric acid (70% or less)
4. Organic Acids
Acetic acid 2
Acrylic acid 2
Butyric acid
Cashew nut shell oil (untreated)
Citric acid
Chloroacetic acid solution
Chloropropionic acid
Decanoic acid
2,2-Dichloropropionic acid
2,2-Dimethyloctanoic acid
2-Ethylhexanoic acid
Formic acid 2
Glycolic acid
Glyoxylic acid
n-Heptanoic acid
Hexanoic acid
2-Hydroxy-4-(methylthio)butanoic acid
Methacrylic acid
Naphthenic acid
Neodecanoic acid
Nonanoic acid
Nonanoic, Tridecanoic acid mixture
Octanoic acid

n-Pentanoic acid, 2-Methyl butryic acid mixture
Pentanoic acid
Propionic acid
Trimethylacetic acid
Undecanoic acid
5. Caustics
Ammonium sulfide solution
[[Page 44]]
Calcium hypochlorite solutions
Caustic potash solution 2
Caustic soda solution 2
Cresylate spent caustic
Cresylic acid, sodium salt solution
Kraft black liquor
Kraft pulping liquors
Mercaptobenzothiazol, sodium salt solution
Potassium hydroxide solution 2
Sodium acetate, Glycol, Water mixture (containing Sodium hydroxide)
Sodium aluminate solution
Sodium borohydride, Sodium hydroxide solution
Sodium carbonate solutions
Sodium cyanide solution
Sodium hydrosulfide solution 2
Sodium hydrosulfide, Ammonium sulfide solution 2
Sodium hydroxide solution 2
Sodium hypochlorite solution

Sodium 2-mercaptobenzothiazol solution
Sodium naphthenate solution
Sodium nitrite solution
Triphenylborane, Caustic soda solution
Trisodium phosphate solution
Vanillin black liquor
6. Ammonia
Ammonia, anhydrous
Ammonia, aqueous
Ammonium hydroxide (28% or less Ammonia)
Ammonium nitrate, Urea solution (containing Ammonia)
Urea, Ammonium nitrate solution (containing Ammonia)
7. Aliphatic Amines
N-Aminoethylpiperazine
Butylamine
Cyclohexylamine
Dibutylamine
Diethylamine [2]
Diethylenetriamine [2]
Diisobutylamine
Diisopropylamine
Dimethylamine
Dimethylamine solution
N,N-Dimethylcyclohexylamine
N,N-Dimethyldodecylamine
Di-n-propylamine
Diphenylamine, reaction product with 2,2,4-Trimethylpentene
Diphenylamines, alkylated
Dodecylamine, Tetradecylamine mixture [2]
Dodecyldimethylamine, Tetradecyldimethylamine mixture
Ethylamine [2]
Ethylamine solution
Ethyleneamine EA 1302 [2]
N-Ethyl-n-butylamine
N-Ethyl cyclohexylamine
Ethylenediamine [2]
2-Ethyl hexylamine
N-Ethylmethylallylamine
Glyphosate solution (not containing surfactant)
Hexamethylenediamine
Hexamethylenediamine solution
Hexamethylenetetramine
Hexamethylenetetramine solutions
Hexamethylenimine
HiTec 321
bis-(Hydrogenated tallow alkyl)methyl amines
Isophorone diamine
Long chain polyetheramine in alkyl(C2-C4)benzenes
Metam sodium solution
Methylamine solutions
Morpholine [2]
Oleylamine
Pentaethylenehexamine
Pentaethylenehexamine, Tetraethylenepentamine mixture
Phosphate esters, alkyl (C12-C14) amine
Polyethylene polyamines [2]
Polyolefin amide alkeneamine (C28+)
Polyisobutenamine in aliphatic (C10-C14) solvent
Poly (C17+) olefin amine
Polyolefin amide alkeneamine/Molybdenum oxysulfide mixture
Propanil, Mesityl oxide, Isophorone mixture

Propylamine
iso-Propylamine solution
Roundup
Sulfohydrocarbon, long chain (C18+) alkylamine mixture
Tetraethylenepentamine [2]
Triethylamine
Triethylenetetramine [2]
Trimethylamine solution
Trimethylhexamethylene diamine (2,2,4- and 2,4,4-)
8. Alkanolamines
2-(2-Aminoethoxy)ethanol
Aminoethyldiethanolamine, Aminoethylethanolamine solution
Aminoethylethanolamine
2-Amino-2-methyl-1-propanol
Diethanolamine
Diethylaminoethanol
Diethylethanolamine
Diisopropanolamine
Dimethylethanolamine
Ethanolamine
Ethoxylated long chain (C16+) alkyloxyalkanamine
Methyl diethanolamine
Propanolamine
Triethanolamine [2]
Triisopropanolamine
Ucarsol CR Solvent 302 SG
9. Aromatic Amines
Alkyl (C8-C9) phenylamine in aromatic solvents
Aniline
Calcium long chain alkyl phenolic amine (C8-C40)
4-Chloro-2-methylphenoxyacetic acid, Dimethylamine salt solution
Dialkyl (C8-C9) diphenylamines
2,6-Diethylaniline
Dimethylamine salt of 4-Chloro-2-methylphenoxyacetic acid solution
2,6-Dimethylaniline
Diphenylamine
2-Ethyl-6-methyl-N-(1'-methyl-2-methoxyethyl)aniline
2-Methyl-6-ethyl aniline
2-Methyl-5-ethyl pyridine
Methyl pyridine
3-Methylpyridine
N-Methyl-2-pyrrolidone [2]
Paraldehyde-Ammonia reaction product
Pyridine
Pyridine bases
Toluenediamine
p-Toluidine
10. Amides
Acetochlor
Acrylamide solution
Alkenyl(C11+)amide
N,N-Dimethylacetamide
N,N-Dimethylacetamide solution
Dimethylformamide
Formamide
N,N-bis(2-Hydroxyethyl) oleamide
Octadecenoamide
Zinc alkenyl carboxamide
11. Organic Anhydrides
Acetic anhydride
Alkenylsuccinic anhydride

Maleic anhydride
Phthalic anhydride
Polyisobutenyl anhydride adduct
Polyolefin anhydride
Propionic anhydride
12. Isocyanates
Diphenylmethane diisocyanate
Hexamethylene diisocyanate
Isophorone diisocyanate
Polymethylene polyphenyl isocyanate
Toluene diisocyanate
Trimethylhexamethylene diisocyanate (2,2,4- and 2,4,4-)
13. Vinyl Acetate
Vinyl acetate
Vinyl ethyl ether
Vinyl neodecanate
Vinyl toluene
14. Acrylates
Butyl acrylate
Butyl methacrylate
Butyl methacrylate, Decyl methacrylate, Cetyl-Eicosyl methacrylate mixture
Cetyl-Eicosyl methacrylate mixture
Decyl acrylate
Dodecyl methacrylate
Dodecyl-Octadecyl methacrylate mixture
Dodecyl-Pentadecyl methacrylate mixture
Ethyl acrylate
2-Ethylhexyl acrylate
Ethyl methacrylate
2-Hydroxyethyl acrylate [2]
Methacrylic resin in Ethylene dichloride
Methyl acrylate
Methyl methacrylate
Nonyl methacrylate
Polyalkyl(C18 - C22) acrylate in Xylene
Polyalkyl (C10-C18) methacrylate/Ethylene
Polyalkyl (C10-C20) methacrylate
Propylene copolymer mixture
Roehm monomer 6615
15. Substituted Allyls
Acrylonitrile [2]
Allyl alcohol [2]
Allyl chloride
1,3-Dichloropropene
Dichloropropene, Dichloropropane mixtures
Methacrylonitrile
16. Alkylene Oxides
Butylene oxide
Ethylene oxide, Propylene oxide mixtures
Propylene oxide
17. Epichlorohydrin
Chlorohydrins
Epichlorohydrin
18. Ketones
Acetone [2]
Acetophenone
Amyl methyl ketone
Butyl heptyl ketone
Camphor oil
1-(4-Chlorophenyl)-4,4-dimethyl pentan-3-one [2]

Cyclohexanone
Cyclohexanone, Cyclohexanol mixtures [2]
Diisobutyl ketone
Ethyl amyl ketone
Epoxy resin
Ketone residue
Isophorone [2]
Mesityl oxide [2]
Methyl amyl ketone
Methyl butyl ketone
Methyl butyl ketone
Methyl ethyl ketone [2]
Methyl heptyl ketone
Methyl isoamyl ketone
Methyl isobutyl ketone [2]
Methyl propyl ketone
Trifluralin in Xylene
19. Aldehydes
Acetaldehyde
Acrolein [2]
Butyraldehyde
Crotonaldehyde [2]
Decaldehyde
Ethylhexaldehyde
2-Ethyl-3-propylacrolein [2]
Formaldehyde, Methanol mixtures [2]
Formaldehyde solution [2]
Furfural
Glutaraldehyde solution
Glyoxal solutions
3-Methyl butyraldehyde
Methylolureas
3-(Methylthio)propionaldehyde
Octyl aldehyde
Paraldehyde
Pentyl aldehyde
Propionaldehyde
Valeraldehyde
20. Alcohols, Glycols
Acrylonitrile-Styrene copolymer dispersion in Polyether polyol
Alcoholic beverages
Alcohol polyethoxylates
Alcohol polyethoxylates, secondary
Alcohols (C13+)
Amyl alcohol
Behenyl alcohol
Brake fluid base mixtures
1,4-Butanediol
Butyl alcohol [2]
Butylene glycol [2]
Cetyl-Stearyl alcohol
Choline chloride solutions
Cyclohexanol
Decyl alcohol [2]
Diacetone alcohol [2]
Diethyl hexanol
Diisobutyl carbinol
2,2-Dimethylpropane-1,3-diol
Dodecanol
Dodecyl alcohol
Ethoxylated alcohols, C11-C15

2-Ethoxyethanol
Ethyl alcohol 2
Ethyl butanol
Ethylene chlorohydrin
Ethylene cyanohydrin
Ethylene glycol 2
2-Ethylhexanol
Furfuryl alcohol 2
Glycerine 2
Glycerine, Dioxanedimethanol mixture
Glycerol monooleate
Heptanol
Hexamethylene glycol
Hexanol
Hexylene glycol
Hydroxy terminated polybutadiene
Icosa(oxypropane-2,3-diyl)s
Lauryl polyglucose (50% or less)
3-Methoxy-1-butanol
Methyl alcohol 2
Methyl amyl alcohol
Methyl butenol
Methylbutynol
2-Methyl-2-hydroxy-3-butyne
Methyl isobutyl carbinol
3-Methyl-3-methoxybutanol
2-Methyl-1,3-propanediol
Molasses
Nonyl alcohol 2
Octanol \2\
Octyl alcohol 2
Penacosa(oxypropane-2,3-diyl)s
Pentadecanol
Polyalkylene oxide polyol
Polybutadiene, hydroxy terminated
Polyglycerol
Polyglycerine, Sodium salts solution (containing less than 3% Sodium hydroxide) \2\
Polyolefin amide alkeneamine polyol
Propyl alcohol 2
Propylene glycol 2
Rum
Sorbitol solutions
Stearyl alcohol
Tallow fatty alcohol
Tetradecanol
Tridecanol
Trimethyl nonanol
Trimethylol propane polyethoxylate
Undecanol
Undecyl alcohol
21. Phenols, Cresols
Benzyl alcohol
Carbolic oil
Creosote 2
Cresols
Cresylic acid
Cresylic acid dephenolized
Cresylic acid, tar
Dibutylphenols
2,4-Dichlorophenol

Dodecyl phenol
o-Ethylphenol
Long chain alkylphenate/phenol sulfide mixture
Nonyl phenol
Octyl phenol
Phenol
Xylenols
22. Caprolactam Solutions
Caprolactam solution
23-29. Unassigned
30. Olefins
Amylene
Aryl polyolefin (C11-C50)
Butadiene
Butadiene, Butylene mixtures (cont. Acetylenes)
Butene
Butene oligomer
Butylene
1,5,9-Cyclododecatriene
1,3-Cyclopentadiene dimer
Cyclopentadiene, Styrene, Benzene mixture
Cyclopentene
Decene
Dicyclopentadiene
Diisobutylene
Dipentene
Dodecene
Ethylene
Ethylene-Propylene copolymer
Ethylidene norbornene 2
1-Heptene
Hexene
Isoprene
Isoprene concentrate (Shell)
Latex (ammonia (1% or less) inhibited)
Methyl acetylene, Propadiene mixture
Methyl butene
Methylcyclopentadiene dimer
2-Methyl-1-pentene
4-Methyl-1-pentene
alpha-Methyl styrene
Myrcene
Nonene
1-Octadecene
Octene
Olefin mixtures
alpha-Olefins (C6 - C18) mixtures
alpha-Olefins (C13+)
1,3-Pentadiene
Pentene
alpha-Pinene
beta-Pinene
Polybutene
Poly(4+)isobutylene
Polyolefin (molecular weight 300+)
Polypropylene
Poly(5+)propylene
Propylene
Propylene-butylene copolymer
Propylene dimer
Propylene, Propane, MAPP gas mixture

Propylene tetramer
Propylene trimer
Styrene
Tetradecene
Tridecene
Triisobutylene
Tripropylene
Turpentine
Undecene
31. Paraffins
Alkanes (C6-C9)
n-Alkanes (C10+)
iso- & cyclo-Alkanes (C10-C11)
iso- & cyclo-Alkanes (C12+)
Butane
Cycloheptane
Cyclohexane
Cyclopentane
Decane
Dodecane
Ethane
Ethyl cyclohexane
Heptane
Hexane 2
Methane
Methylcyclohexane
2-Methyl pentane
Nonane
Octane
Pentane
Propane
iso-Propylcyclohexane
Tridecane
Waxes:
Paraffin
32. Aromatic Hydrocarbons
Alkyl(C3-C4)benzenes
Alkyl(C5-C8)benzenes
Alkyl(C9+)benzenes
Alkyl acrylate-Vinyl pyridine copolymer in Toluene
Alkylbenzene, Alkylindane, Alkylindene mixture (each C12-C17)
Benzene
Benzene hydrocarbon mixtures (having 10% Benzene or more)
Benzene, Toluene, Xylene mixtures
Butylbenzene
Butyl phenol, Formaldehyde resin in Xylene
Butyl toluene
Cumene
Cymene
Decylbenzene
Dialkyl(C10 - C14) benzenes
Diethylbenzene
Diisopropylbenzene
Diisopropyl naphthalene
Diphenyl
Dodecylbenzene
Dodecyl xylene
Ethylbenzene
Ethyl toluene
1-Hexadecylnaphthalene, 1,4-bis(Hexadecyl)
Isopropylbenzene

Methyl naphthalene
Naphthalene
Naphthalene mixture
Naphthalene still residue
1-Phenyl-1-xylyl ethane
Poly(2+)cyclic aromatics
Polyolefin amine in alkylbenzenes (C2-C4)
Propylbenzene
Pseudocumene
C9 Resinfeed (DSM) 2
Tetradecylbenzene
Tetrahydronaphthalene
1,2,3,5-Tetramethylbenzene
Toluene
Tridecylbenzene
Triethylbenzene
Trimethylbenzene
Undecylbenzene
Xylene
Xylenes, Ethylbenzene mixture
33. Miscellaneous Hydrocarbon Mixtures
Alachlor
Alkylbenzenesulfonic acid, sodium salt solutions
Alkyl dithiothiadiazole (C6-C24)
Asphalt blending stocks, roofers flux
Asphalt blending stocks, straight run residue
Asphalt emulsion
Aviation alkylates
Calcuim sulfonate, Calcium carbonate, Hydrocarbon solvent mixture
Coal tar
Coal tar distillate
Coal tar, high temperature
Coal tar pitch
Decahydronaphthalene
Degummed C9 (DOW)
Diphenyl, Diphenyl ether
Distillates, flashed feed stocks
Distillates, straight run
Drilling mud (low toxicity) (if flammable or combustible)
Gas oil, cracked
Gasoline blending stock, alkylates
Gasoline blending stock, reformates
Gasolines:
Automotive (not over 4.23 grams lead per gal.)
Aviation (not over 4.86 grams lead per gal.)
Casinghead (natural)
Polymer
Straight run
Jet Fuels:
JP-4
JP-5
JP-8
Kerosene
Mineral spirits
Naphtha:
Coal tar solvent
Petroleum
Solvent
Stoddard solvent
Varnish Makers' and Painters'
Oil, fuel:

No. 1
No. 1-D
No. 2
No. 2-D
No. 4
No. 5
No. 6
Oil, misc:
Aliphatic
Aromatic
Clarified
Coal
Crude
Diesel
Gas, high pour
Heartcut distillate
Linseed
Lubricating
Mineral
Mineral seal
Motor
Neatsfoot
Penetrating
Pine
Rosin
Sperm
Spindle
Turbine
Residual
Road
Transformer
Oxyalkylated alkyl phenol formaldehyde
Petrolatum
Pine oil
Polyolefin amine (C28-C250)
Polyolefin amide alkeneamine (C17+)
Polyolefin amide alkeneamine borate (C28-C250)
Sodium petroleum sulfonate
Sulfohydrocarbon (C3-C88)
Waxes:
Petroleum
Sulfurized fat (C14-C20)
Sulfurized polyolefinamide alkeneamines (C28-C250)
White spirit (low (15-20%) aromatic)
34. Esters
Alkane (C14-C17) sulfonic acid, sodium salt solution
Alkyl(C8+)amine, Alkenyl (C12+) acid ester mixture
Alkyl ester copolymer (C6-C18)
Alkyl(C7-C9) nitrates \2\
Alkyl (C8-C40) phenol sulfide
Alkyl (C10-C20, saturated and unsaturated) phosphite
Alkyl sulfonic acid ester of phenol
Alkylaryl phosphate mixtures (more than 40%
Amyl acetate
Animal and Fish oils, n.o.s.
Animal and Fish acid oils and distillates, n.o.s.
Barium long chain alkaryl (C11-C50) sulfonate
Barium long chain alkyl(C8-C14)phenate sulfide
Benzene tricarboxylic acid trioctyl ester
Benzyl acetate
Butyl acetate

Butyl benzyl phthalate
n-Butyl butyrate
Butyl formate
iso-Butyl isobutyrate
n-Butyl propionate
Calcium alkyl(C9)phenol sulfide, polyolefin phosphorosulfide mixture
Calcium long chain alkaryl sulfonate (C11-C50)
Calcium long chain alkyl phenate sulfide (C8-C40)
Calcium long chain alkyl phenates
Calcium long chain alkyl salicylate (C13+)
Calcium nitrate, Magnesium nitrate, Potassium chloride solution
Calcium nitrate solution
Cobalt naphthenate in solvent naphtha
Coconut oil, fatty acid
Copper salt of long chain alkanoic acids
Cottonseed oil, fatty acid
Cyclohexyl acetate
Decyl acetate
Dialkyl(C7 - C13) phthalates
Dibutyl hydrogen phosphonate
Dibutyl phthalate
Diethylene glycol butyl ether acetate
Diethylene glycol dibenzoate
Diethylene glycol ethyl ether acetate
Diethylene glycol methyl ether acetate
Diethylene glycol phthalate
Di-(2-ethylhexyl)adipate
Di-(2-ethylhexyl)phthalate
Diethyl phthalate
Diethyl sulfate
Diheptyl phthalate
Dihexyl phthalate
Di-n-hexyl adipate
Diisobutyl phthalate
Diisodecyl phthalate
Diisononyl adipate
Diisononyl phthalate
Diisooctyl phthalate
Dimethyl adipate
Dimethylcyclicsiloxane hydrolyzate
Dimethyl glutarate
Dimethyl hydrogen phosphite 2
Dimethyl naphthalene sulfonic acid, sodium salt solution
2
Dimethyl phthalate
Dimethyl polysiloxane
Dimethyl succinate
Dinonyl phthalate
Dioctyl phthalate
Diphenyl tolyl phosphate, less than 0.02% ortho-isomer)
Dipropylene glycol dibenzoate
Dithiocarbamate ester (C7-C35)
Ditridecyl adipate
Ditridecyl phthalate
2-Dodecenylsuccinic acid, dipotassium salt solution
Diundecyl phthalate
2-Ethoxyethyl acetate
Ethyl acetate
Ethyl acetoacetate
Ethyl butyrate
Ethylene carbonate
Ethylene glycol acetate

Ethylene glycol butyl ether acetate
Ethylene glycol diacetate
Ethylene glycol ethyl ether acetate
Ethylene glycol methyl ether acetate
Ethyl-3-ethoxypropionate
Ethyl hexyl phthalate
Ethyl propionate
Ethyl propionate
Fatty acids (saturated, C14+)
Glycerol polyalkoxylate
Glyceryl triacetate
Glycidyl ester of C10 trialkyl acetic acid
Gylcidyl ester of tridecylacetic acid
Heptyl acetate
Hexyl acetate
Lauric acid
Lecithin
Magnesium long chain alkaryl sulfonate (C11-C50)
Magnesium long chain alkyl phenate sulfide (C8-C20)
Magnesium long chain alkyl salicylate (C11+)
3-Methoxybutyl acetate
1-Methoxy-2-propyl acetate
Methyl acetate
Methyl acetoacetate
Methyl amyl acetate
Methyl butyrate
Methyl formate
3-Methyl-3-methoxybutyl acetate
Methyl salicylate
Metolachlor
Naphthalene sulfonic acid, sodium salt solution (40% or less)
Nonyl acetate
n-Octyl acetate
Octyl decyl adipate
Oil, edible:
Beechnut
Castor
Cocoa butter
Coconut [2]
Cod liver
Corn
Cotton seed
Fish [2]
Groundnut
Hazelnut
Lard
Lanolin
Nutmeg butter
Olive
Palm [2]
Palm kernel
Peanut
Poppy
Poppy seed
Raisin seed
Rapeseed
Rice bran
Safflower
Salad
Sesame
Soya bean

Sunflower
Sunflower seed
Tucum
Vegetable
Walnut
Oil, misc:
Animal
Coconut oil, fatty actid methyl ester
Cotton seed oil, fatty acid
Lanolin
Palm kernel oil, fatty acid methyl ester
Palm oil, methyl ester
Pilchard
Perilla
Soapstock
Soyabean (epoxidized)
Tall
Tall, fatty acid [2]
Tung
Olefin/Alkyl ester copolymer (molecular weight 2000+)
Oleic acid
Palm kernel acid oil
Palm kernel acid oil, methyl ester
Palm stearin
n-Pentyl propionate
Poly(2-8)alkylene glycol monoalkyl(C1-C6) ether acetate
Polydimethylsiloxane
Polyferric sulfate solution
Polymethylsiloxane
Poly(20)oxyethylene sorbitan monooleate
Polysiloxane
Polyolefin aminoester salt
Polyolefin ester (C28-C250)
Polyolefin phosphorosulfide, barium derivative (C28-C250)
Potassium formate solution
Potassium oleate
Potassium salt of polyolefin acid
Propyl acetate
Propylene carbonate
Propylene glycol methyl ether acetate
Sodium acetate, Glycol, Water mixture (not containing Sodium hydroxide) \2\
Sodium acetate solution
Sodium benzoate solution
Sodium dimethyl naphthalene sulfonate solution [2]
Sodium long chain alkyl salicylate (C13+)
Sodium naphthalene sulfonate solution
Soyabean oil (epoxidized)
Stearic acid
Tall oil
Tall oil fatty acid (Resin acids less than 20%) [2]
Tallow [2]
Tallow fatty acid [2]
Tributyl phosphate
Tricresyl phosphate
Tridecanoic acid
Tridecyl acetate
Triethylene glycol dibenzoate
Triethylene glycol di-(2-ethylbutyrate)
Triethyl phosphate
Triethyl phosphite [2]

Triisooctyl trimellitate [2]
Triisopropylated phenyl phosphates
2,2,4-Trimethyl-1,3-pentanediol diisobutyrate
2,2,4-Trimethyl-1,3-pentanediol-1-isobutyrate
2,2,4-Trimethyl-3-pentanol-1-isobutyrate
Trimethyl phosphite [2]
Trisodium nitrilotriacetate
Trixylyl phosphate
Trixylenyl phosphate
Vegetable acid oils and distillates, n.o.s.
Vegetable oils, n.o.s.
Waxes:
Carnauba
Zinc alkaryl dithiophosphate (C7-C16)
Zinc alkyl dithiophosphate (C3-C14)
35. Vinyl Halides
Vinyl chloride
Vinylidene chloride
36. Halogenated Hydrocarbons
Benzyl chloride
Bromochloromethane
Carbon tetrachloride [2]
Catoxid feedstock [2]
Chlorinated paraffins (C10 - C13)
Chlorinated paraffins (C14 - C17)
Chlorobenzene
Chlorodifluoromethane
Chloroform
Chlorotoluene
Dibromomethane
Dibutylphenols
3,4-Dichloro-1-butene
Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane
1,6-Dichlorohexane
2,2'-Dichloroisopropyl ether
Dichloromethane
Dichloropropane
Ethyl chloride
Ethylene dibromide
Ethylene dichloride [2]
Methyl bromide
Methyl chloride
Monochlorodifluoromethane
n-Propyl chloride
Pentachloroethane
Perchloroethylene
1,1,2,2-Tetrachloroethane
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane [2]
1,1,2-Trichloroethane
Trichloroethylene [2]
1,2,3-Trichloropropane
1,1,2-Trichloro-1,2,2-trifluoroethane
37. Nitriles
Acetonitrile
Adiponitrile
Lactonitrile solution
Propionitrile

Tallow nitrile
38. Carbon Disulfide
Carbon disulfide
39. Sulfolane
Sulfolane
40. Glycol Ethers
Alkyl (C7-C11) phenol poly(4-12)ethoxylate
Alkyl (C9-C15) phenyl propoxylate
Diethylene glycol \2\
Diethylene glycol butyl ether
Diethylene glycol dibutyl ether
Diethylene glycol diethyl ether
Diethylene glycol ethyl ether
Diethylene glycol methyl ether
Diethylene glycol n-hexyl ether
Diethylene glycol phenyl ether
Diethylene glycol propyl ether
Dipropylene glycol
Dipropylene glycol butyl ether
Dipropylene glycol methyl ether
Ethoxy triglycol
Ethylene glycol hexyl ether
Ethylene glycol methyl butyl ether
Ethylene glycol monoalkyl ethers
Ethylene glycol tert-butyl ether
Ethylene glycol butyl ether
Ethylene glycol dibutyl ether
Ethylene glycol ethyl ether
Ethylene glycol isopropyl ether
Ethylene glycol methyl ether
Ethylene glycol phenyl ether
Ethylene glycol phenyl ether, Diethylene glycol phenyl ether mixture
Ethylene glycol propyl ether
Hexaethylene glycol
Methoxy triglycol
Nonyl phenol poly(4+)ethoxylates
Pentaethylene glycol methyl ether
Polyalkylene glycol butyl ether
Polyalkylene glycols, Polyalkylene glycol monoalkyl ethers mixtures
Polyethylene glycols
Polyethylene glycol dimethyl ether
Poly(2-8)alkylene glycol monoalkyl(C1-C6) ether
Polyethylene glycol monoalkyl ether
Polypropylene glycol methyl ether
Polypropylene glycols
Poly(tetramethylene ether) glycols (mw 950-1050)
Polytetramethylene ether glycol
n-Propoxypropanol
Propylene glycol monoalkyl ether
Propylene glycol ethyl ether
Propylene glycol methyl ether
Propylene glycol n-butyl ether
Propylene glycol phenyl ether
Propylene glycol propyl ether
Tetraethylene glycol
Tetraethylene glycol methyl ether
Triethylene glycol
Triethylene glycol butyl ether
Triethylene glycol butyl ether mixture
Triethylene glycol ether mixture
Triethylene glycol ethyl ether

Triethylene glycol methyl ether
Tripropylene glycol
Tripropylene glycol methyl ether
41. Ethers
Alkaryl polyether (C9-C20)
tert-Amyl methyl ether
Butyl ether
2,2'-Dichloroethyl ether
Diethyl ether
Diglycidyl ether of Bisphenol A
Diglycidyl ether of Bisphenol F
Dimethyl furan
1,4-Dioxane
Diphenyl ether
Diphenyl ether, Diphenyl phenyl ether mixture
Ethyl tert-butyl ether [2]
Ethyl ether
Long chain alkaryl polyether (C11-C20)
Methyl-tert-butyl ether [2]
Methyl tert-pentyl ether
Propyl ether
Tetrahydrofuran
1,3, 5-Trioxane
Polyether (molecular weight 2000+)
42. Nitrocompounds
o-Chloronitrobenzene
Dinitrotoluene
Nitrobenzene
Nitroethane
Nitroethane, 1-Nitropropane mixture
Nitropropane
Nitropropane, Nitroethane mixtures
Nitrotoluene
43. Miscellaneous Water Solutions
Alkyl polyglucoside solutions
Aluminum sulfate solution [2]
2-Amino-2-hydroxymethyl-1,3-propanediol solution
Ammonium bisulfite solution [2]
Ammonium lignosulfonate solution
Ammonium nitrate, Urea solution (not containing Ammonia)
Ammonium polyphosphate solution
Ammonium sulfate solution
Ammonium thiosulfate solution
Sulfonated polyacrylate solutions \2\
Calcium bromide solution
Calcium chloride solution
Calcium lignosulfonate solution
Caramel solutions
Clay slurry
Corn syrup
Dextrose solution
2,4-Dichlorophenoxyacetic acid, Diethanolamine salt solution
2,4-Dichlorophenoxyacetic acid, Triisopropanolamine salt solution [2]
Diethanolamine salt of 2,4-Dichlorophenoxyacetic acid solution
Diethylenetriamine pentaacetic acid, pentasodium salt solution
Dodecyl diphenyl ether disulfonate solution
Drilling brine (containing Calcium, Potassium, or Sodium salts)
Drilling brine (containing Zinc salts)
Drilling mud (low toxicity) (if non-flammable or non-combustible)
Ethylenediaminetetracetic acid, tetrasodium salt solution
Ethylene-Vinyl acetate copolymer emulsion

Ferric hydroxyethylethylenediamine triacetic acid, trisodium salt solution 2
Fish solubles (water based fish meal extracts)
Fructose solution
Fumaric adduct of Rosin, water dispersion
Hexamethylenediamine adipate solution
N-(Hydroxyethyl)ethylene diamine triacetic acid, trisodium salt solution
Kaolin clay slurry
Latex, liquid synthetic
Lignin liquor
Liquid Streptomyces solubles
l-Lysine solution
N-Methylglucamine solution
Naphthenic acid, sodium salt solution
Potassium chloride solution
Potassium thiosulfate solution
Rosin soap (disproportionated) solution
Sewage sludge, treated
Sodium alkyl sulfonate solution
Sodium hydrogen sulfite solution
Sodium lignosulfonate solution
Sodium polyacrylate solution 2
Sodium salt of Ferric hydroxyethylethylenediamine triacetic acid solution
Sodium silicate solution 2
Sodium sulfide solution
Sodium sulfite solution
Sodium tartrates, Sodium succinates solution
Sulfonated polyacrylate solutions 2
Tall oil soap (disproportionated) solution
Tetrasodium salt of EDTA solution
Titanium dioxide slurry
Triisopropanolamine salt of 2,4-Dichlorophenoxyacetic acid solution
Urea, Ammonium nitrate solution (not containing Ammonia)
Urea, Ammonium phosphate solution
Urea solution
Vegetable protein solution (hydrolysed)
Water

Footnotes to Table II

\1\ Because of very high reactivity or unusual conditions of carriage or potential compatibility problems, this product is not assigned to a specific group in the Compatibility Chart. For additional compatibility information, contact Commandant (G-MSO), U.S. Coast Guard, 2100 Second Street, SW., Washington, DC 20593-0001. Telephone (202) 267-1577.

\2\ See Appendix I--Exceptions to the Chart.

[CGD 88-100, 54 FR 40012, Sept. 29, 1989, as amended by CGD 88-100, 55 FR 17276, Apr. 24, 1990; CGD 92-100, 59 FR 17025, Apr. 11, 1994; CGD 94-902, 60 FR 34043, June 29, 1995; CGD 95-900, 60 FR 34049, 34050, June 29, 19955; CGD 96-041, 61 FR 50731, Sept. 27, 1996; USCG 2000-7079, 65 FR 67182, Nov. 8, 2000]

Appendix I to Part 150--Exceptions to the Chart

(a). The binary combinations listed below have been tested as prescribed in Appendix III and found not to be dangerously reactive. These combinations are exceptions to the Compatibility Chart (Figure 1) and may be stowed in adjacent tanks.

Member of reactive group	Compatible with
Acetone (18)	Diethylenetriamine (7)

Acetone cyanohydrin (0)..... Acetic acid (4)
Acrylonitrile (15)..... Triethanolamine (8)
1,3-Butylene glycol (20)..... Morpholine (7)
1,4-Butylene glycol (20)..... Ethylamine (7)
Triethanolamine (8)
gamma-Butyrolactone (0)..... N-Methyl-2-pyrrolidone (9)
Caustic potash, 50% or less (5)..... Isobutyl alcohol (20)
Ethyl alcohol (20)
Ethylene glycol (20)
Isopropyl alcohol (20)
Methyl alcohol (20)
iso-Octyl alcohol (20)
Caustic soda, 50% or less (5)..... Butyl alcohol (20)
tert-Butyl alcohol, Methanol
mixtures
Decyl alcohol (20)
iso-Decyl alcohol (20)
Diacetone alcohol (20)
Diethylene glycol (40)
Dodecyl alcohol (20)
Ethyl alcohol (20)
Ethyl alcohol (40%, whiskey)
(20)
Ethylene glycol (20)
Ethylene glycol, Diethylene
glycol mixture (20)
Ethyl hexanol (Octyl
alcohol) (20)
Methyl alcohol (20)
Nonyl alcohol (20)
iso-Nonyl alcohol (20)
Propyl alcohol (20)
iso-Propyl alcohol (20)
Propylene glycol (20)
Sodium chlorate solution (0)
iso-Tridecanol (20)
tert-Dodecanethiol (0)..... Acrylonitrile (15)
Diisodecyl phthalate (34)
Methyl ethyl ketone (18)
iso-Nonyl alcohol (20)
Perchloroethylene (36)
iso-Propyl alcohol (20)
Tall oil, crude
Dodecyl and Tetradecylamine mixture (7)... Tall oil, fatty acid (34)
Ethylenediamine (7)..... Butyl alcohol (20)
tert-Butyl alcohol (20)
Butylene glycol (20)
Creosote (21)
Diethylene glycol (40)
Ethyl alcohol (20)
Ethylene glycol (20)
Ethyl hexanol (20)
Glycerine (20)
Isononyl alcohol (20)
Isophorone (18)
Methyl butyl ketone (18)
Methyl iso-butyl ketone (18)
Methyl ethyl ketone (18)
Propyl alcohol (20)
Propylene glycol (20)
Oleum (0)..... Hexane (31)

Dichloromethane (36)
Perchloroethylene (36)
1,2-Propylene glycol (20)..... Diethylenetriamine (7)
Polyethylene polyamines (7)
Triethylenetetramine (7)
Sodium dichromate, 70% (0)..... Methyl alcohol (20)
Sodium hydrosulfide solution (5)..... Methyl alcohol (20)
Iso-Propyl alcohol (20)
Sulfuric acid (2)..... Coconut oil (34)
Coconut oil acid (34)
Palm oil (34)
Tallow (34)
Sulfuric acid, 98% or less (2)..... Choice white grease tallow (34)

(b). The binary combinations listed below have been determined to be dangerously reactive, based on either data obtained in the literature or on laboratory testing which has been carried out in accordance with procedures prescribed in Appendix III. These combinations are exceptions to the Compatibility Chart (Figure 1) and may not be stowed in adjacent tanks.Acetone cyanohydrin (0) is not compatible with Groups 1-12, 16, 17 and 22.
Acrolein (19) is not compatible with Group 1, Non-Oxidizing Mineral Acids.Acrylic acid (4) is not compatible with Group 9, Aromatic Amines.Acrylonitrile (15) is not compatible with Group 5 (Caustics).Alkylbenzenesulfonic acid (0) is not compatible with Groups 1-3, 5-9,15, 16, 18, 19, 30, 34, 37, and strong oxidizers.Allyl alcohol (15) is not compatible with Group 12, Isocyanates.Alkyl(C7-C9) nitrates (34) is not compatible with Group 1, Non-oxidizing Mineral Acids.Aluminum sulfate solution (43) is not compatible with Groups 5-11.Ammonium bisulfite solution (43) is not compatible with Groups 1, 3, 4,and 5.Benzenesulfonyl chloride (0) is not compatible with Groups 5-7, and 43.1,4-Butylene glycol (20) is not compatible with Caustic soda solution,50% or less (5).gamma-Butyrolactone (0) is not compatible with Groups 1-9.C9 Resinfeed (DSM) (32) is not compatible with Group 2, Sulfuric acid.Carbon tetrachloride (36) is not compatible with Tetraethylenepentamine or Triethylenetetramine, both Group 7, Aliphatic amines.Catoxid feedstock (36) is not compatible with Group 1, 2, 3, 4, 5, or12.
Caustic soda solution, 50% or less (5) is not compatible with 1,4-Butylene glycol (20).
1-(4-Chlorophenyl)-4,4-dimethyl pentan-3-one (18) is not compatible with Group 5 (Caustics) or 10 (Amides).
Crotonaldehyde (19) is not compatible with Group 1, Non-Oxidizing

Mineral Acids.
Cyclohexanone, Cyclohexanol mixture (18) is not compatible with Group 12, Isocyanates.
2,4-Dichlorophenoxyacetic acid, Triisopropanolamine salt solution (43) is not compatible with Group 3, Nitric Acid.
2,4-Dichlorophenoxyacetic acid, Dimethylamine salt solution (0) is not compatible with Groups 1-5, 11, 12, and 16.
Diethylenetriamine (7) is not compatible with 1,2,3-Trichloropropane, Group 36, Halogenated hydrocarbons.
Dimethyl hydrogen phosphite (34) is not compatible with Groups 1 and 4.
Dimethyl naphthalene sulfonic acid, sodium salt solution (34) is not compatible with Group 12, Formaldehyde, and strong oxidizing agents.
Dodecylbenzenesulfonic acid (0) is not compatible with oxidizing agents and Groups 1, 2, 3, 5, 6, 7, 8, 9, 15, 16, 18, 19, 30, 34, and 37.
Ethylenediamine (7) and Ethyleneamine EA 1302 (7) are not compatible with either Ethylene dichloride (36) or 1,2,3-Trichloropropane (36).

Ethylene dichloride (36) is not compatible with Ethylenediamine (7) or Ethyleneamine EA 1302 (7).
Ethylidene norbornene (30) is not compatible with Groups 1-3 and 5-8.
2-Ethyl-3-propylacrolein (19) is not compatible with Group 1, Non-Oxidizing Mineral Acids.
Ethyl tert-butyl ether (41) is not compatible with Group 1, Nonoxidizing mineral acids.
Ferric hydroxyethylethylenediamine triacetic acid, Sodium salt solution (43) is not compatible with Group 3, Nitric acid.
Fish oil (34) is not compatible with Sulfuric acid (2).
Formaldehyde (over 50%) in Methyl alcohol (over 30%) (19) is not compatible with Group 12, Isocyanates.
Formic acid (4) is not compatible with Furfural alcohol (20).
Furfuryl alcohol (20) is not compatible with Group 1, Non-Oxidizing Mineral Acids and Formic acid (4).
2-Hydroxyethyl acrylate (14) is not compatible with Group 5, 6, or 12.
Isophorone (18) is not compatible with Group 8, Alkanolamines.
Magnesium chloride solution (0) is not compatible with Groups 2, 3, 5, 6 and 12.
Mesityl oxide (18) is not compatible with Group 8, Alkanolamines.
Methacrylonitrile (15) is not compatible with Group 5 (Caustics).
Methyl tert-butyl ether (41) is not compatible with Group 1, Nonoxidizing Mineral Acids.
NIAX POLYOL APP 240C (0) is not compatible with Group 2, 3, 5, 7, or 12.
o-Nitrophenol (0) is not compatible with Groups 2, 3, and 5-10.
Octyl nitrates (all isomers), see Alkyl(C7-C9) nitrates.
Oleum (0) is not compatible with Sulfuric acid (2) and 1,1,1-Trichloroethane (36).
Phthalate based polyester polyol (0) is not compatible with group 2, 3, 5, 7 and 12.
Polyglycerine, Sodium salts solution (20) is not compatible with Groups 1, 4, 11, 16, 17, 19, 21 and 22.
Propylene, Propane, MAPP gas mixture (containing 12% or less MAPP gas) (30) is not compatible with Group 1 (Non-oxidizing mineral acids), Group 36 (Halogenated hydrocarbons), nitrogen dioxide, oxidizing materials, or molten sulfur.
Sodium acetate, Glycol, Water mixture (1% or less Sodium hydroxide) (34) is not compatible with Group 12 (Isocyanates).
Sodium chlorate solution (50% or less) (0) is not compatible with Groups 1-3, 5, 7, 8, 10, 12, 13, 17 and 20.
Sodium dichromate solution (70% or less) (0) is not compatible with Groups 1-3, 5, 7, 8, 10, 12, 13, 17 and 20.
Sodium dimethyl naphthalene sulfonate solution (34) is not compatible with Group 12, Formaldehyde and strong oxidizing agents.
Sodium hydrogen sulfide, Sodium carbonate solution (0) is not compatible with Groups 6 (Ammonia) and 7 (Aliphatic amines).
Sodium hydrosulfide (5) is not compatible with Groups 6 (Ammonia) and 7 (Aliphatic amines).
Sodium hydrosulfide, Ammonium sulfide solution (5) is not compatible with Groups 6 (Ammonia) and 7 (Aliphatic amines).
Sodium polyacrylate solution (43) is not compatible with Group 3, Nitric Acid.
Sodium silicate solution (43) is not compatible with Group 3, Nitric Acid.
Sodium sulfide, hydrosulfide solution (0) is not compatible with Groups 6 (Ammonia) and 7 (Aliphatic amines).
Sodium thiocyanate (56% or less) (0) is not compatible with Groups 1-4.
Sulfonated polyacrylate solution (43) is not compatible with Group 5 (Caustics).
Sulfuric acid (2) is not compatible with Fish oil (34), or Oleum (0).
Tall oil fatty acid (Resin acids less than 20%) (34) is not compatible

with Group 5, Caustics.
Tallow fatty acid (34) is not compatible with Group 5, Caustics.
Tetraethylenepentamine (7) is not compatible with Carbon tetrachloride, Group 36, Halogenated hydrocarbons.
1,2,3-Trichloropropane (36) is not compatible with Diethylenetriamine, Ethylenediamine, Ethyleaneamine EA 1302, or Triethylenetetramine, all Group 7, Aliphatic amines.
1,1,1-Trichloroethane (36) is not compatible with Oleum (0).
Trichloroethylene (36) is not compatible with Group 5, Caustics.
Triethylenetetramine (7) is not compatible with Carbon tetrachloride, or 1,2,3-Trichloropropane, both Group 36, Halogenated hydrocarbons.
Triethyl phosphite (34) is not compatible with Groups 1, and 4.
Trimethyl phosphite (34) is not compatible with Groups 1 and 4.
1,3,5-Trioxane (41) is not compatible with Group 1 (non-oxidizing mineral acids) and Group 4 (Organic acids).
[CGD 88-100, 54 FR 40012, Sept. 29, 1989 as amended by CGD 88-100, 55 FR 17277, Apr. 24, 1990; CDG 92-100, 59 FR 17026, Apr. 11, 1994; CGD 94-902, 60 FR 34043, June 29, 1995; CGD 95-900, 60 FR 34050, June 29, 1995; USCG 2000-7079, 65 FR 67182, Nov. 8, 2000]

Appendix II to Part 150--Explanation of Figure 1

Definition of a hazardous reaction-- As a first approximation, a mixture of two cargoes is considered hazardous when, under specified condition, the temperature rise of the mixture exceeds 25 [deg]C or a gas is evolved. It is possible for the reaction of two cargoes to produce a product that is significantly more flammable or toxic than the original cargoes even though the reaction is non-hazardous from temperature or pressure considerations, although no examples of such a reaction are known at this time.
Chart format-- There are different degrees of reactivity among the various cargoes. Many of them are relatively non-reactive: For example, aromatic hydrocarbons or paraffins. Others will form hazardous combinations with many groups: For example, the inorganic acids.
The cargo groups in the compatibility chart are separated into two categories: 1 through 22 are ``Reactive Groups'' and 30 through 43 are ``Cargo Groups''. Left unassigned and available for future expansion are groups 23 through 29 and those past 43. Reactive Groups contain products which are chemically the most reactive; dangerous combinations may result between members of different Reactive Groups and between members of Reactive Groups and Cargo Groups. Products assigned to Cargo Groups, however, are much less reactive; dangerous combinations involving these can be formed only with members of certain Reactive Groups. Cargo Groups do not react hazardously with one another.
Using the Compatibility Chart-- The following procedure explains how the compatibility chart should be used to find compatibility infomation:

(1) Determine the group numbers of the two cargoes by referring to the alphabetical listing of cargoes and the corresponding groups (Table I). Many cargoes are listed under their parent names; unless otherwise indicated, isomers or mixtures of isomers of a particular cargo are assigned to the same group. For example, to find the group number for Isobutyl Alcohol, look under the parent name Butyl Alcohol. Similarly, the group number for para-Xylene is found under the entry Xylene. If a cargo cannot be found in this listing, contact the Coast Guard for a group determination (see Sec. 150.140).
(2) If both group numbers are between 30 and 43 inclusive, the products are compatible and the chart need not be used.
(3) If both group numbers do not fall between 30 and 43 inclusive, locate one of the numbers on the left of the chart (Cargo Groups) and the other across the top (Reactive Groups). (Note that if a group number is between 30 and 43, it can only be found on the left side of the chart.) The box formed by the intersection of the column and row

containing the two numbers will contain one of the following:
(a) Blank--The two cargoes are compatible.
(b) ``X''--The two cargoes are not compatible.
(Note that reactivity may vary among the group members. Refer to Table I or Table II to find whether the products in question are referenced by a footnote which indicates that exceptions exist and are listed in Appendix I. Unless the combination is specifically mentioned in Appendix I, it is compatible.)
[CGD 75-59, 45 FR 70263, Oct. 23, 1980, as amended by CGD 83-047, 50 FR 33046, Aug. 16, 1985]

Examples

Combination Groups	Compatible
Butyraldehyde/Acetic Acid	19/4 Yes.
Allyl Alcohol/Toluene Diisocyanate	15/12 No.
Decene/Ethyl Benzene	30/32 Yes.
Ethanolamine/Acetone	8/18 Yes.
Ammonia/Dimethylformamide	6/10 No.

Appendix III to Part 150--Testing Procedures for Determining Exceptions to the Chart

experimental procedure for evaluating binary chemical reactivity

General safety precautions--Chemical reactivity tests have, by their nature, serious potential for injuring the experimenter or destroying equipment. The experimenter should 1) have knowledge of the magnitude of the reactivity to be expected, 2) use adequate facilities and protective equipment to prevent injury from splatter of materials or release of fumes, and 3) start on a small scale so that unexpected reactions can be safely contained. All tests should be performed in a well-ventilated laboratory hood provided with shields.

Testing chemicals other than liquids--The procedure outlined below was developed for chemicals which are liquids at ambient temperatures. If one or both chemicals are normally shipped at elevated temperatures, the same procedure may be followed except the chemicals are tested at their respective shipping temperatures and the oil bath in Step 3 is maintained at a level 25 [deg]C above the higher temperature. This information is then indicated on the data sheet. If one of the chemicals is a gas at ambient temperatures, consult the Coast Guard for additional instructions before proceeding with the compatibility test.

Step 1

Objective--To determine if the test chemicals react violently and present a safety hazard in further tests.Procedure--Place 0.5ml of one (A) of the test chemicals in a 25x150mm test tube. Clamp the test tube to a stand behind a safety shield (in a hood). Carefully add from a dropper 0.5ml of the other substance (B). Shake to induce mixing. If no immediate reaction occurs,etain the mixture for at least 10 minutes to check for a delayed reaction.Results--If a violent reaction occurs, such as sputtering, boiling of reactants or release of fumes, record the results on the Data Sheet (appendix IV) and do not proceed to Step 2. If no reaction or a minor reaction occurs, proceed to Step 2.

Step 2

Objective--To determine the heat of reaction of two chemicals on mixing under specified conditions.Procedure--These separate mixes of the proposed binary combination will be tested. These are 2 ml : 18 ml, 10 ml : 10 ml, and 18 ml : 2 ml,respectively, to result in a final mixture of about 20 ml in each case.A reference-junctioned thermocouple is prepared by inserting twolengths of 20 gauge or finer iron-constantan or chromelalumel duplex thermocouple wire into glass capilary sheaths. The common wire of each probe is joined, while the other wire of each is connected to a stripchart

recorder. The thermocouple probe which produces a negative pen deflection upon warming is the reference junction and is placed in a test tube of water at ambient laboratory temprature. The other probe is placed near the bottom of a Dewar flask of about 300ml capacity, such that the thermocouple will be below the surface of the test mixture. The Dewar flask is equipped with a magnetic stirrer having a stirring bar coated with an inert material such as a flourinated hydrocarbon.Start the temperature recorder and stirrer. Deliver the test chemicals to the Dewar Flask simultaneously from separate graduated syringes. If an exothermic reaction occurs, continue the test until the maximum temperature is reached and begins to subside. If no apparent reaction occurs, continue the test for at least 30 minutes to check for a delayed reaction. Stop agitation and observe the mixture at five-minute intervals to determine if the mixture is miscible, if gases are evolved, or if other visible changes occur. In the interest of safety, a mirror can be used for these observations. Repeat the above test for the other mixture combinations.Results--Record the results in the appropriate places on the Data Sheet. If no reaction occurs or if the temperature rise is less than 25 [deg]C, proceed to Step 3. If the observed temperature rise exceeds 25 [deg]C or gases are evolved, do not proceed to Step 3.

Step 3

Objective--To determine if exothermic reactions occur at temperatures up to 50 [deg]C.Procedure--If a non-hazardous reaction occurred in Step 2, the ratio of chemicals which resulted in the greatest temperature rise will be tested. Fresh chemicals will be used with a total volume for this test of about 10ml (a ratio of 1ml:9ml, 5ml:5ml, or 9ml:1ml). If no reaction was observed in Step 2, use a ratio of 5ml:5ml. Using the thermocouple prepared for Step 2, insert the reference probe into a 25x150mm test tube containing 10ml of water. Place the other probe into an empty test tube. Start the temperature recorder and add the two chemicals of the combination, one at a time, to the empty test tube. Lower the two test tubes into an oil bath maintained at 50 <PLUS-MINUS2 [deg]C.Hold the samples in the oil bath until the maximum temperature differential is recorded, and in all cases at least 15 minutes. Observe the test mixture to determine if gases are evolved or if other visible changes occur. Follow prescribed safety precautions.Results --Record the maximum differential temperature measured, the time required to reach this temperature, and any other observations in the proper space on the Data Sheet.Send a copy of the Data Sheet for each binary chemical mixture tested to: Commandant (G-MSO), U.S. Coast Guard, Washington, DC 20593-0001.

[CGD 75-59, 45 FR 70263, Oct. 23, 1980, as amended by CGD 82-063b, 48 FR 4782, Feb. 3, 1983; CGD 83-047, 50 FR 33046, Aug. 16, 1985; CGD 88-070, 53 FR 34535, Sept. 7, 19885; CGD 96-041, 61 FR 50731, Sept. 27, 1996]

Appendix IV to Part 150--Data Sheet

[GRAPHIC] [TIFF OMITTED] TC02FE91.080

[GRAPHIC] [TIFF OMITTED] TC02FE91.081

ADDENDUM 5

APPENDIX B
LIST OF CARGOES – VAPOUR CONTROL

Contents

A.General
A 100 List of Cargoes

101. This list of cargoes to be used only for information. The vapour growth rate and the vapor-air mixture density are to be calculated based on the formulas included in the manual. This list covers a range of cargoes normally carried, and gives vapour pressure and specific gravity, as well as density of vapour/air mixture and vapour growth rate at 46ºC.

Chemical name	Vapour pressure 46ºC KPa, abs.	Vapour specific gravity	Vap/air density 46ºC (kg/m3)	Vapour growth rate
Acetic acid	6,34	2,07	1,413	1,02
Acetic annhydride	2,76	3,5	1,414	1,01
Acetone	68,95	2	2,098	1,2
Acetone cyanohydrin	2,76	2,9	1,396	1,01
Acetonitrile	0,21	1,41	1,339	1
Acrylic acid	2,76	2,48	1,383	1,01
Acrylonitrile	34,47	1,8	1,642	1,1
Adiponitrile	0,07	3,73	1,34	1
Allyı alcohol	12,41	2	1,475	1,04
Allyl chloride	73,08	2,64	2,66	1,21
Aminoethyletanolamine	0,07	3,59	1,34	1
Amylacetate (commercial, iso, n-, sec-)	2,34	4,5	1,429	1,01
Amyl acetate (iso-)	2,34	4,5	1,429	1,01
Amyl acetate (n-)	2,34	4,5	1,429	1,01
Aniline	0,28	3,22	1,345	1
Benzene (50/50 mix air)	31,03	2,8	2,542	1,25
Benzenei Toluene, Xylene mixture (10% Benzene or more)	50,33	2,8	2,337	1,15

Chemical name	Vapour pressure 46ºC KPa, abs.	Vapour specific gravity	Vap/air density 46ºC (kg/m3)	Vapour growth rate
Benzyl chloride	0,62	4,36	1,413	1,00
Butyl acetate (n-)	5,52	4,00	1,521	1,02
Butyl acetate (iso-, n-)	4,14	4,00	1,475	1,01
Butyl acetate (sec-)	10,34	4,00	1,680	1,03
Butyl acrylate (iso-, n-)	4,14	4,42	1,494	1,01
Butyl alcohol (iso-)	6,21	2,60	1,448	1,02
Butyl alcohol (n-)	3,45	2,60	1,399	1,01
Butyl alcohol (sec-)	8,96	2,60	1,496	1,03
Butyl alcohol (tert-)	19,31	2,60	1,679	1,06
Butyly benzyl phtalate	0,07	10,80	1,346	1,00
Butyl ether (n-)	2,76	4,50	1,445	1,01
Butyl methacrylate	2,00	4,90	1,424	1,01
Butylamine (all isomers) (vap. Res. Varies betw. 3.2-15)	68,95	2,50	2,479	1,20
Butylene glycol	0,07	3,10	1,340	1,00
Butylene oxide(1,2-)	49,64	2,49	2,154	1,14
Butyraldehyde (iso-, n-)	55,16	2,48	2,238	1,16
Butyraldehyde (n-, crude)	55,16	2,48	2,238	1,16
Butyraldehydes (crude)	55,16	2,48	2,238	1,16
Butyric aicd	0,48	3,04	1,349	1,00
Caprolactam solutions	4,83	3,90	1,492	1,01

Chemical name	Vapour pressure 46ºC KPa, abs.	Vapour specific gravity	Vap/air density 46ºC (kg/m3)	Vapour growth rate
Carbon disulfide	3,45	2,67	1,400	1,01
Carbon tetrachloride	37,23	5,49	3,181	1,11
Chloro benzene	5,52	3,88	1,513	1,02
Chloroform	62,05	4,25	3,562	1,18
Chloro sulfonic acid	0,55	4,00	1,356	1,00
Creosote (all isomers)	0,07	3,72	1,340	1,00
Creosote (cole tar)	0,07	3,72	1,340	1,00
Creosote (wood)	0,07	3,72	1,340	1,00
Cresols	0,41	3,72	1,351	1,00
Crotonaldehyde	13,79	2,41	1,552	1,04
Cumene	4,14	4,20	1,484	1,01
Cyclohexane	31,03	2,90	1,988	1,09
Cyclohexanol	1,38	3,50	1,376	1,00
Cyclohexanone	1,38	3,40	1,375	1,00
Cyclohexylamine	4,27	3,42	1,452	1,01
Cymene (para)	3,17	4,62	1,465	1,01
Decaldehyde(iso-)	0,41	5,38	1,358	1,00
Decyclopentadiene	1,72	4,55	1,406	1,01
Decyl alcohol (all isomers)	0,07	5,30	1,341	1,00
Decyl alcohol (iso-)	0,07	5,30	1,341	1,00
Decyl alcohol (n-)	0,07	5,30	1,341	1,00
Decyl acrylate (iso-n-)	0,07	7,30	1,343	1,00
Diacetone alcohol	0,69	4,00	1,361	1,00
Dibutylamine	1,24	4,46	1,385	1,00
Dichlorobenzene (all isomers)	0,69	5,07	1,369	1,00
Dichloroethane (1,1-)	68,26	3,41	3,152	1,20

Chemical name	Vapour pressure 46ºC KPa, abs.	Vapour specific gravity	Vap/air density 46ºC (kg/m3)	Vapour growth rate
Dichloroethyl ether (2,2-)	0,28	4,90	1,350	1,00
Dichloro-methane	131,00	3,00	4,227	1,38
Dichlorophenol (2,4-)	0,07	5,60	1,342	1,00
Dichloropropane (1,2-)	17,24	3,89	1,887	1,05
Dichloropropene (1,3-)	37,92	3,84	2,526	1,11
Diethanolamine	0,07	3,65	1,340	1,00
Diethylamine	6,89	2,50	1,452	1,02
Diethylbenzene	0,55	4,62	1,360	1,00
Diethylene glycol	0,07	3,66	1,340	1,00
Diethylene glycol butyl ether	0,07	5,50	1,342	1,00
Diethylene glycol etyl ether	0,07	4,62	1,341	1,00
Diethylene glycol methyl ether	0,14	4,14	1,343	1,00
Diethylenetriamine	0,28	3,48	1,346	1,00
Diethylethanolamine	1,03	4,03	1,373	1,00
Diisobutyl ketone	3,31	4,90	1,480	1,01
Diisobutylamine	3,17	4,46	1,459	1,01
Diisobutylcarbinol	0,69	4,98	1,368	1,00
Diisobutylene	15,17	3,97	1,835	1,04
Diisopropanolamine	0,07	4,59	1,341	1,00
Diisopropylamine	25,51	3,50	2,041	1,07
Diethylamine solution (45% or less)	70,33	1,55	1,765	1,20
Dimethylformamide	2,07	2,51	1,373	1,01

Chemical name	Vapour pressure 46ºC KPa, abs.	Vapour specific gravity	Vap/air density 46ºC (kg/m3)	Vapour growth rate
Dioctylphtalate	0,07	13,45	1,348	1
Dioxane(1,4-)	12,41	3,00	1,612	1,04
Diphenyl, Diphenyl ether mixture	0,07	5,87	1,342	1
Diphenylmethane diisocynate	0,07	8,50	1,344	1
Dipropylene glycol	0,48	4,63	1,357	1,00
Dipropylene glycol dibenzoate	0,07	8,50	1,344	1,00
Dodecene	0,14	5,81	1,345	1,00
Dodecylbenzene	32,41	8,40	3,982	1,09
Epichlorohydrin	6,89	3,19	3,982	1,02
Ethanolamine	0,21	2,10	1,341	1,00
Ethoxy triglycol (crude)	0,07	6,14	1,342	1,00
Ethyl acetate	31,03	3,04	2,036	1,09
Ethyl acrylate	13,79	3,50	1,718	1,04
Ethyl alcohol	24,13	1,60	1,498	1,07
Ethyl butanol	0,97	3,40	1,364	1,00
Ethyl ether	158,58	2,55	4,049	1,46
Ethyl hexanol (2-)	0,14	4,50	1,343	1,00
Ethyl methacrylate	6,89	3,94	1,562	1,02
Ethyl-3-propylacrolein (2-)	0,83	4,35	1,369	1,00
Ethylamine	281,31	1,55	3,044	1,82
Ethylamine solution (72% or less)	106,87	1,56	1,998	1,31
Ethylbenzene	4,14	3,56	1,455	1,01
Ethylbutylamine (n-)	8,27	3,50	1,566	1,02
Ethylene chlorohydrine	3,03	2,78	1,398	1,01

Chemical name	Vapour pressure 46ºC KPa, abs.	Vapour specific gravity	Vap/air density 46ºC (kg/m3)	Vapour growth rate
Ethylene cyanohydrin	0,07	2,45	1,339	1,00
Ethylene dibromide	0,48	6,50	1,367	1,00
Ethylene dichloride	27,58	3,42	2,074	1,08
Ethylene glycol	0,07	2,21	1,339	1,00
Ethylene glycol butyl ether	22,08	4,07	2,085	1,06
Ethylene glycol ethyl ether	1,17	3,10	1,365	1,00
Ethylene glycol methyl ether	4,14	2,62	1,412	1,01
Ethylene diamine	6,21	2,10	1,413	1,02
Ethylhexyl acrylte (2-)	0,14	6,35	1,346	1,00
Ethylidene norbornene	2,28	4,10	1,416	1,01
Formaldehyde solution (37% to 50%)	1,03	1,03	1,338	1,00
Formic acid	14,48	1,60	1,434	1,04
Furfural	1,03	3,31	1,364	1,00
Furfuryl alcohol	0,69	3,37	1,356	1,00
Gasoline blending sotcks: Alkylates (50/50 mix air)	86,18	3,40	2,944	1,25
Gasoline blending sotcks: Reformates (50/50 mix air)	86,18	3,40	2,944	1,25
Gasolines: Automotive (< 4,23grams lead/gallon) (50/50mix air)	86,18	3,40	2,944	1,25

Chemical name	Vapour pressure 46ºC KPa, abs.	Vapour specific gravity	Vap/air density 46ºC (kg/m3)	Vapour growth rate
Gasolines: Aviation (< 4.86 grams lead/gallon) (50/50 mix air)	86.18	3.40	2.944	1.25
Gasolines: Casinghead (natural) (50/50 mix air)	86.18	3.40	2.944	1.25
Gasolines: Polymer (50/50 mix air)	86.18	3.40	2.944	1.25
Gasolines: Straight run (50/50 mix air)	86.18	3.40	2.944	1.25
Glycerine	0.07	3.17	1.340	1.00
Heptane (all isomers)	17.24	3.45	1.804	1.05
Heptane (n-)	17.24	3.45	1.804	1.05
Hexamethylenediami-ne solution	0.07	1.00	1.338	1.00
Hexane (all isomers) (average vap. Press., real: 7-9)	55.16	3.00	2.555	1.16
Hexane (average vap. Press., real: 7-9)	55.16	3.00	2.555	1.16
Hexanol (1-)	6.89	3.52	1.530	1.02
Hydrochloric acid	72.39	1.26	1.546	1.21
iso-Butyraldehyde	55.16	2.48	2.238	1.16
iso-Propylamine	159.27	2.04	3.165	1.46
Isophorone	0.07	4.75	1.341	1,00
Isoprene	158.58	2.35	3.699	1.46
Kerosene	1.03	4.50	1.378	1.01
Light virgin Naphta	96.53	0.66	0.976	1.28
Mesityl oxide	4.62	3.50	1.446	1,01

Chemical name	Vapour pressure 46ºC KPa, abs.	Vapour specific gravity	Vap/air density 46ºC (kg/m3)	Vapour growth rate
Methacrylicacid	0.69	2.50	1.350	1.00
Methacrylonitrile	74.46	1.17	1.478	1.22
Methyl acetate	42.06	2.60	2.080	1.12
Methyl acrylate	28.27	3.00	1.962	1.08
Methyl alcohol	48.26	1.11	1.397	1.14
Methyl ethyl ketone	31.03	2.50	1.851	1.09
Methyl isobutyl ketone	8.27	3.45	1.562	1.02
Methyl methacrylate	13.93	3.45	1.714	1.04
Methyl-5-ethyl-pyridine (2-)	1.10	4.18	1.377	1.00
Methyl-6-ethyl-aniline (2-)	0.07	4.67	1.341	1.00
Methylamine solution, 40%	89.63	1.07	1.407	1.26
Methylamyl acetate	2.34	5.00	1.441	1.01
Methylamyl alcohol	2.76	3.50	1.414	1.01
Methylpyridine (2-)	3.45	3.20	1.422	1.01
Methylstyrene (alpha-)	2.76	4.08	1.432	1.01
Mineral spirits (average vapour s.g.)	1.38	4.15	1.386	1.00
Morpholine	5.52	3.00	1.460	1.02
Naphtalene (molten)	0.07	4.42	1.341	1.00
Nitric acid (70% or less)	24.82	2.17	1.658	1.07
Nitrobenzene	0.14	4.24	1.343	1.00
Nitropropane (1- or 2-)	7.24	3.06	1.503	1.02

Chemical name	Vapour pressure 46ºC Kpa, abs.	Vapour specific gravity	Vap/air density 46ºC (kg/m3)	Vapour growth rate
Nitrotoluene (o-, p-)	0,14	4,72	1,344	1,00
Nonane	2,76	4,41	1,442	1,01
Nonene	2,41	4,30	1,426	1,01
Nonyl phenol	0,07	7,59	1,343	1,00
Octyl alcohol (iso-)	0,21	4,50	1,346	1,00
Octyl nitrates (all isomers)	2,14	6,00	1,456	1,01
Oil, edible: Castor	1,03	10,00	1,441	1,00
Oil misc.: Crude	1,03	3,40	2,900	1,25
Oleum	0,07	2,76	1,339	1,00
Paraldhyde	57,23	4,55	3,578	1,17
Pentadiene (1,3-)	117,62	2,36	3,102	1,34
Pentane (all isomers)	144,79	2,48	3,701	1,42
Pentane (iso-)	186,16	2,48	4,376	1,54
Perchloroethylene	8,48	5,83	1,790	1,02
Phenol, or solutions with 5% or more Phenol	4,14	3,24	1,440	1,01
Posphoric acid	0,07	3,38	1,340	1,00
Phthalic anhydride (molten)	0,07	5,10	1,341	1,00
Propanolamine (iso-,n-)	0,55	2,59	1,348	1,00
Propionaldhyde	96,53	2,00	2,402	1,28
Propionic acid	2,07	2,60	1,374	1,01
Propionic anhydride	0,07	4,49	1,341	1,00
Propionitrile	16,55	1,40	1,411	1,05
Propyl acetate (iso-)	21,37	3,52	1,932	1,06
Propyl acetate (n-)	13,10	3,52	1,702	1,04
Propyl alcohol (iso-)	20,68	2,07	1,582	1,06

Chemical name	Vapour pressure 46ºC Kpa, abs.	Vapour specific gravity	Vap/air density 46ºC (kg/m3)	Vapour growth rate
Propyl alcohol (n-)	8,27	2,07	1,436	1,02
Propylamine (n-)	92,39	2,04	2,398	1,27
Propylene oxide	151,68	2,00	3,011	1,44
Pyridine	8,96	2,72	1,508	1,03
Sodium hydrosulfide solution (45% or less)	10,41	1,17	1,358	1,03
Sorbitol solution	0,07	3,20	1,340	1,00
Styrene	2,76	3,60	1,417	1,01
Styrene (crude)	2,76	3,60	1,417	1,01
Sulfuric acid	0,07	3,40	1,340	1,00
Tetra chloroethane (1,1,2,2-)	6,89	5,80	1,703	1,02
Tetraethylene glycol	0,07	6,70	1,342	1,00
Tetraethylene pentamine	0,07	6,80	1,343	1,00
Tetrahydrofuran	58,61	1,65	1,564	1,00
Tetrahydronaphtalene	0,28	4,55	1,349	1,17
Toluene	10,34	3,14	1,582	1,00
Toluene diisocyanate	0,07	6,00	1,342	1,03
Trichlorobenzene (1,2,4-)	0,07	6,26	1,342	1,00
Trichloroethane (1,1,1-)	33,78	4,60	2,679	1,00
Trichloroethylene	24,13	4,54	2,280	1,07
Trichloropropane (1,2,3-)	1,03	5,60	1,391	1,00
Tricresyl phosphate (1% or more of ortho isomer)	0,07	12,70	1,347	1,00
Tricresyl phosphate (less than 1% of ortho isomer)	0,07	12,70	1,347	1,00
Tridecanol	0,07	6,70	1,343	1,00

Chemical name	Vapour pressure 46ºC KPa, abs.	Vapour specific gravity	Vap/air density 46ºC (kg/m3)	Vapour growth rate
Triethanolamine	0,07	5,14	1,341	1,00
Triethylamine	17,24	3,49	1,811	1,05
Triethylbenzene	0,34	5,60	1,356	1,00
Triethylene glycol	0,07	5,17	1,341	1,00
Triethylene glycol methyl ether	0,07	5,66	1,342	1,00
Triethylenetetramine	0,07	5,04	1,341	1,00
Tripropylene glycol	0,07	6,63	1,342	1,00
Turpentine	0,28	4,84	1,350	1,00
Valeraldehyde (iso-,n-)	12,41	2,96	1,606	1,04
Valeraldehyde (n-)	12,41	2,96	1,606	1,04
Vinyl acetate	39,99	2,97	2,181	1,12
Vinyl ethyl ether	143,41	2,49	3,694	1,42
Vinylidene chloride	165,47	3,34	5,608	1,48
Vinyltoluene	0,83	4,08	1,366	1,00
Xylene (m-)	3,52	3,66	1,441	1,01
Xylene (p-)	3,52	3,66	1,441	1,01
Xylene (o-)	2,76	3,66	1,419	1,01