



**MARPOL 73/78 Annex II  
Procedures and Arrangements  
Manual Template**

MARPOL 73/78 ANNEX II PROCEDURES & ARRANGEMENTS MANUAL TEMPLATE			
Vessel Name:		IMO No.:	

## Foreword

This document is a template to assist the shipowner/operator/designer in preparing a Procedures and Arrangements Manual demonstrating compliance with the requirements of MARPOL Annex II. The Manual must be approved by either the relevant flag Administration for the vessel or by a classification society delegated to act on behalf of the flag Administration for IBC Code certification. To assist in this process, the completed template should be submitted to an ABS Engineering Office for review.

The standard format for the manual is contained in Appendix 4 of MARPOL Annex II. The following template repeats the standard format as written and also includes added guidance provided by ABS for the preparer of the document to facilitate the subsequent engineering review.

## Disclaimer

This document has been developed solely as guidance for the shipowner/operator/designer preparing a Procedures and Arrangements Manual as required by the relevant sections of MARPOL Annex II. Users should refer to the applicable sections of MARPOL as necessary. Users are also urged to consult with their local ABS engineering office should more detailed interpretations be required. Any variation between applicable regulations and the information provided in this document is unintentional, and, in the case of such variations, the requirements of the regulations govern. This guidance does not constitute advice by ABS and may not be relied upon to create a contractual right or benefit enforceable by any person.

**The front cover and this page are to be deleted prior to submission for review.**

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## Instructions to Owners/Operators/Designers on the Use of the Following Template for the Procedures and Arrangements Manual

The text in **BLACK** is verbatim from MARPOL Annex II Appendix 4 and must be maintained in the Manual for each ship.

*The text in **RED** italics is verbatim from MARPOL Annex II Appendix 4 and must be edited as necessary for each ship.*

The text in **BLUE** has been added by ABS as guidance/recommendations. This text should be deleted or edited as necessary prior to submission of the document for review.

The format consists of a standardized introduction and index of the leading paragraphs to each section. MARPOL Annex II Appendix 4 requires that this standardized part be reproduced in the Manual of each ship and that it be followed by the contents of each section as prepared for the particular ship.

When a section is not applicable, “NA” must be entered so as not to lead to any disruption of the numbering as required by the standard format.

Where the paragraphs of the standard format are printed in *italics*, the required information must be provided for that particular ship. The contents will vary from ship to ship because of design, trade and intended cargoes.

Where the text is not in italics, that text of the standard format must be copied into the Manual without any modification.

If the Administration requires or accepts information and operational instructions in addition to those outlined in this Standard Format, this information should be included in Addendum D of the Manual.

**This page is to be deleted prior to submission for review.**

## MARPOL 73/78 Annex II Procedures and Arrangements Manual

Name of Ship	
Distinctive Number or Letters	
IMO Number	
Port of Registry	
Year of Build	
Gross Tonnage	
Deadweight	
Tonnage	
Length (B.P.)	
Length (O.A.)	
Ship Type (IBC)	
Classification	
Notation	

Approval Stamp of Administration:

## Introduction

1. The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (hereinafter referred to as MARPOL 73/78) was established in order to prevent the pollution of the marine environment by discharges into the sea from ships of harmful substances or effluents containing such substances. In order to achieve its aim, MARPOL 73/78 contains six Annexes in which detailed regulations are given with respect to the handling on board ships and the discharge into the sea or release into the atmosphere of six main groups of harmful substances, i.e. Annex I (Mineral oils), Annex II (Noxious Liquid Substances carried in bulk), Annex III (Harmful substances carried in packaged forms), Annex IV (Sewage), Annex V (Garbage) and Annex VI (Air Pollution).
2. Regulation 13 of Annex II of MARPOL 73/78 (hereinafter referred to as Annex II) prohibits the discharge into the sea of Noxious Liquid Substances (NLS) of Categories X, Y or Z or of ballast water, tank washings or other residues or mixtures containing such substances, except in compliance with specified conditions including procedures and arrangements based upon standards developed by the International Maritime Organization (IMO) to ensure that the criteria specified for each Category will be met..
3. Annex II requires that each ship which is certified for the carriage of noxious liquid substances in bulk shall be provided with a Procedures and Arrangements Manual, hereinafter referred to as the “Manual”.
4. This Manual has been written in accordance with regulation 14 of Annex II and is concerned with the marine environmental aspects of the cleaning of cargo tanks and the discharge of residues and mixtures from these operations. The Manual is not a safety guide and reference shall be made to other publications specifically to evaluate safety hazards.
5. The purpose of the Manual is to identify the arrangements and equipment required to enable compliance with Annex II and to identify for the ship’s officers all operational procedures with respect to cargo handling, tank cleaning, slops handling, residue discharging, ballasting and de-ballasting, which must be followed in order to comply with the requirements of Annex II.
6. In addition, this Manual, together with the ship’s Cargo Record Book and the Certificate issued under Annex II\*, will be used by Administrations for control purposes in order to ensure full compliance with the requirements of Annex II by this ship.
7. The master shall ensure that no discharges into the sea of cargo residues or residue/water mixtures containing Category X, Y or Z substances shall take place, unless such discharges are made in full compliance with the operational procedures contained in this Manual.

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8. This Manual has been approved by the Administration and no alteration or revision shall be made to any part of it without the prior approval of the Administration.

\*Include only the Certificate issued to the particular ship: i.e. The International Pollution Prevention Certificate for the carriage of Noxious Liquid Substances in bulk or the Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk or the International Certificate of Fitness for the Carriage of Dangerous Chemicals in Bulk.

## Index of Sections

1. Main features of MARPOL 73/78 Annex II
2. Description of the ship's equipment and arrangements
3. Cargo unloading procedures and tank stripping
4. Procedures relating to the cleaning of cargo tanks, the discharge of residues, ballasting and deballasting
5. Information and Procedures

### Addenda

Addendum A: Flow diagram

Addendum B: Pre-wash procedures

Addendum C: Ventilation procedures

Addendum D: Additional information and operational instructions when required or accepted by the Administration

### INSTRUCTIONS TO TEMPLATE USER:

The index has been expanded by ABS to include Addenda A through D for completeness. It is recommended that these addenda be completed.

## SECTION 1: Main Features of MARPOL 73/78 Annex II

- 1.1 The requirements of Annex II apply to all ships carrying noxious liquid substances in bulk. Substances posing a threat of harm to the marine environment are divided into three categories, X, Y and Z. Category X substances are those posing the greatest threat to the marine environment, whilst Category Z substances are those posing the smallest threat.
- 1.2 Annex II prohibits the discharge into the sea of any effluent containing substances falling under these categories, except when the discharge is made under conditions which are specified in detail for each category. These conditions include, where applicable, such parameters as:
  - .1 the maximum quantity of substances per tank which may be discharged into the sea;
  - .2 the speed of the ship during the discharge;
  - .3 the minimum distance from the nearest land during discharge;
  - .4 the minimum depth of water at sea during discharge; and
  - .5 the need to effect the discharge below the waterline.
- 1.3 For certain sea areas identified as “special area” more stringent discharge criteria apply. Under Annex II the special area is the Antarctic area.
- 1.4 Annex II requires that every ship is provided with pumping and piping arrangements to ensure that each tank designated for the carriage of Category X, Y and Z substances does not retain after unloading a quantity of residue in excess of the quantity given in the Annex. For each tank intended for the carriage of such substances an assessment of the residue quantity has to be made. Only when the residue quantity as assessed is less than the quantity prescribed by the Annex may a tank be approved for the carriage of a Category X, Y or Z substance.
- 1.5 In addition to the conditions referred to above, an important requirement contained in Annex II is that the discharge operations of certain cargo residues and certain tank cleaning and ventilation operations may only be carried out in accordance with approved procedures and arrangements.
- 1.6 To enable the requirement of paragraph 1.5 to be met, this Manual contains in Section 2 all particulars of the ship’s equipment and arrangements, in Section 3 operational procedures for cargo unloading and tank stripping and in Section 4 procedures for discharge of cargo residues, tank washing, slops collection, ballasting and deballasting as may be applicable to the substances the ship is certified fit to carry.
- 1.7 By following the procedures as set out in this Manual, it will be ensured that the ship complies with all relevant requirements of Annex II to MARPOL 73/78.



## SECTION 2:

### Description of the Ship's Equipment and Arrangements

- 2.1 This section contains all particulars of the ship's equipment and arrangements necessary to enable the crew to follow the operational procedures set out in Sections 3 and 4.
- 2.2 General arrangement of ship and description of cargo tanks

*This section shall contain a brief description of the cargo area of the ship with the main features of the cargo tanks and their positions.*

*Line or schematic drawings showing the general arrangement of the ship and indicating the position and numbering of the cargo tanks and heating arrangements shall be included.*

- 2.3 Description of cargo pumping and piping arrangements and stripping system

*This section shall contain a description of the cargo pumping and piping arrangements and of the stripping system. Line or schematic drawings shall be provided showing the following and be supported by textual explanation where necessary:*

- .1 cargo piping arrangements with diameters;*
- .2 cargo pumping arrangements with pump capacities;*
- .3 piping arrangements of stripping system with diameters;*
- .4 pumping arrangements of stripping system with pump capacities;*
- .5 location of suction points of cargo lines and stripping lines inside every cargo tank;*
- .6 if a suction well is fitted, the location and cubic capacity thereof;*
- .7 line draining and stripping or blowing arrangements; and*
- .8 quantity and pressure of nitrogen or air required for line blowing if applicable.*

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#### 2.4 Description of ballast tanks and ballast pumping and piping arrangements

*This section shall contain a description of the ballast tanks and ballast pumping and piping arrangements.*

*Line or schematic drawings and tables shall be provided showing the following:*

- .1 a general arrangement showing the segregated ballast tanks and cargo tanks to be used as ballast tanks together with their capacities (cubic meters);*
- .2 ballast piping arrangement;*
- .3 pumping capacity for those cargo tanks which may also be used as ballast tanks; and*
- .4 any interconnection between the ballast piping arrangements and the underwater outlet system.*

#### 2.5 Description of dedicated slop tanks with associated pumping and piping arrangements

*This section shall contain a description of the dedicated slop tank(s), if any, with the associated pumping and piping arrangements. Line or schematic drawings shall be provided showing the following:*

- .1 which dedicated slop tanks are provided together with the capacities of such tanks;*
- .2 pumping and piping arrangements of dedicated slop tanks with piping diameters and their connection with the underwater discharge outlet.*

#### 2.6 Description of underwater discharge outlet for effluents containing Noxious Liquid Substances

*This section shall contain information on position and maximum flow capacity of the underwater discharge outlet (or outlets) and the connections to this outlet from the cargo tanks and slop tanks. Line or schematic drawings shall be provided showing the following:*

- .1 location and number of underwater discharge outlets;*
- .2 connections to underwater discharge outlets;*
- .3 location of all seawater intakes in relation to underwater discharge outlets.*

#### 2.7 Description of flow rate indicating and recording devices

*[This section has been deleted from the revised Manual requirements and is no longer required.]*

## 2.8 Description of cargo tank ventilation system

*This section shall contain a description of the cargo tank ventilation system.*

*Line or schematic drawings and tables shall be provided showing the following and supported by textual explanation if necessary:*

- .1 the noxious liquid substances the ship is certified fit to carry having a vapour pressure over 5 kPa at 20°C suitable for cleaning by ventilation to be listed in paragraph 4.4.10 of the Manual;*
- .2 ventilation piping and fans;*
- .3 position of the ventilation openings;*
- .4 the minimum flow rate of the ventilation system to adequately ventilate the bottom and all parts of the cargo tank;*
- .5 the location of structures inside the tank affecting ventilation;*
- .6 the method of ventilating the cargo pipeline system, pumps, filters, etc; and*
- .7 means for ensuring that the tank is dry.*

## 2.9 Description of tank washing arrangements and wash water heating system

*This section shall contain a description of the cargo tank washing arrangements, wash water heating system and all necessary tank washing equipment.*

*Line or schematic drawings and tables or charts showing the following:*

- .1 arrangements of piping dedicated for tank washing with pipeline diameters;*
- .2 type of tank cleaning machines with capacities and pressure rating;*
- .3 maximum number of tank cleaning machines which can operate simultaneously;*
- .4 position of deck openings for cargo tank washing;*
- .5 the number of cleaning machines and their location required for ensuring complete coverage of the cargo tank walls;*
- .6 maximum capacity of wash water which can be heated to 60°C by the installed heating equipment; and*
- .7 maximum number of tank cleaning machines which can be operated simultaneously at 60°C.*

## SECTION 3: Cargo Unloading Procedures and Tank Stripping

3.1 This section contains operational procedures in respect of cargo unloading and tank stripping which must be followed in order to ensure compliance with the requirements of Annex II.

3.2 Cargo unloading

*This section shall contain procedures to be followed including the pump and cargo unloading and suction line to be used for each tank. Alternative methods may be given.*

*The method of operation of the pump or pumps and the sequence of operation of all valves shall be given.*

*The basic requirement is to unload the cargo to the maximum extent.*

3.3 Cargo tank stripping

*This section shall contain procedures to be followed during the stripping of each cargo tank.*

*The procedures shall include the following:*

- .1 operation of stripping system;*
- .2 list and trim requirements;*
- .3 line draining and stripping or blowing arrangements if applicable; and*
- .4 duration of the stripping time of the water test.*

3.4 Cargo temperature

*This section shall contain information on the heating requirements of cargoes which have been identified as being required to be at a certain minimum temperature during unloading.*

*Information shall be given on control of the heating system and the method of temperature measurement.*

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3.5 Procedures to be followed when a cargo tank cannot be unloaded in accordance with the required procedures

*This section shall contain information on the procedures to be followed in the event that the requirements contained in Sections 3.3 and/or 3.4 cannot be met due to circumstances such as the following:*

- .1 failure of cargo tank stripping system; and*
- .2 failure of cargo tank heating system.*

3.6 Cargo Record Book

The Cargo Record Book shall be completed in the appropriate places on completion of any cargo operation.

## SECTION 4: Procedures Relating to the Cleaning of Cargo Tanks, the Discharge of Residues, Ballasting and Deballasting

- 4.1 This section contains operational procedures in respect of tank cleaning, ballast and slops handling which must be followed in order to ensure compliance with the requirements of Annex II.
- 4.2 The following paragraphs outline the sequence of actions to be taken and contain the information essential to ensure that noxious liquid substances are discharged without posing a threat of harm to the marine environment.
- 4.3 [\[This sub-paragraph has been deleted from the revised Manual requirements.\]](#)
- 4.4 The information necessary to establish the procedures for discharging the residue of the cargo, cleaning, ballasting and deballasting the tank, shall take into account the following:

.1 Category of substance

The category of the substance should be obtained from the relevant Certificate.

**NOTE TO TEMPLATE USER:**

Since Table 1, including the current standard format for the P & A Manual, has been deleted from the revised MARPOL Annex II, the category of substances and any information on substances cannot be obtained directly from the P & A Manual. Therefore, the equivalent table including "Specific Gravity", "Flash Point" "Ship Type" and other information necessary for carriage of substances should be attached to the P & A Manual. An operation manual including cargo information as shown in 16.2 of the IBC Code is not required to be approved by Administrations under the IBC Code. However, the foregoing table is very convenient and helpful for readers and users of this document.

.2 Stripping efficiency of tank pumping system

*The contents of this section will depend on the design of the ship and whether it is a new ship or existing ship (see flow diagram and pumping/stripping requirements).*

.3 Vessel within or outside a special area

*This section shall contain instructions on whether the tank washings can be discharged into the sea within a special area (as defined in Section 1.3) or outside a special area. The different requirements shall be made clear and will depend on the design and trade of the ship.*

No discharges into the sea of residues of Noxious Liquid Substances, or mixtures containing such substances, are allowed within the Antarctic area (the sea area south of latitude 60°S).

.4 Solidifying or high-viscosity substance

The properties of the substance should be obtained from the shipping document.

.5 Miscibility with water

[This sub-paragraph has been deleted from the revised Manual requirements.]

.6 Compatibility with slops containing other substances

*This section shall contain instructions on the permissible and non-permissible mixing of cargo slops. Reference should be made to compatibility guides.*

.7 Discharge to reception facility

*This section shall identify those substances the residues of which are required to be prewashed and discharged to a reception facility.*

.8 Discharging into the sea

*This section shall contain information on the factors to be considered in order to identify whether the residue/water mixtures are permitted to be discharged into the sea.*

.9 Use of cleaning agents or additives

*This section contains information on the use and disposal of cleaning agents (e.g. solvents used for tank cleaning) and additives to tank washing (e.g. detergents).*

.10 Use of ventilation procedures for tank cleaning

*This section shall make reference to all substances suitable for the use of ventilation procedures.*

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- 4.5. Having assessed the previous information, the correct operational procedures to be followed should be identified using the instructions and flow diagram of Section 5. Appropriate entries shall be made in the Cargo Record Book indicating the procedure adopted.



## SECTION 5: Information and Procedures

*This section shall contain procedures, which will depend on the age of the ship and pumping efficiency. Examples of the flow diagram referred to in this section are given at Addendum A and incorporate comprehensive requirements applicable to both new and existing ships. The Manual for a particular ship shall only contain those requirements specifically applicable to that ship.*

Information relating to melting point and viscosity, for those substances which have a melting point equal to or greater than 0°C or a viscosity equal or greater than 50 mPa.s at 20°C, shall be obtained from the shipping document.

For substances allowed to be carried, reference is made to the relevant Certificate. The Manual shall contain:

Table 1: [\[This Table has been deleted from the revised Manual requirements.\]](#)

Table 2: Cargo tank information.

Addendum A: Flow diagram.

Addendum B: Prewash procedures.

Addendum C: Ventilation procedures.

Addendum D: Additional information and operational instructions when required or accepted by the Administration.

Outlines of the above table and addenda are shown below.

**Table 2 - Cargo tank information**

Tank no. *	Capacity (m <sup>3</sup> )	Stripping quantity (liters)

\* Tank numbers should be identical to those in the ship's Certificate of Fitness.

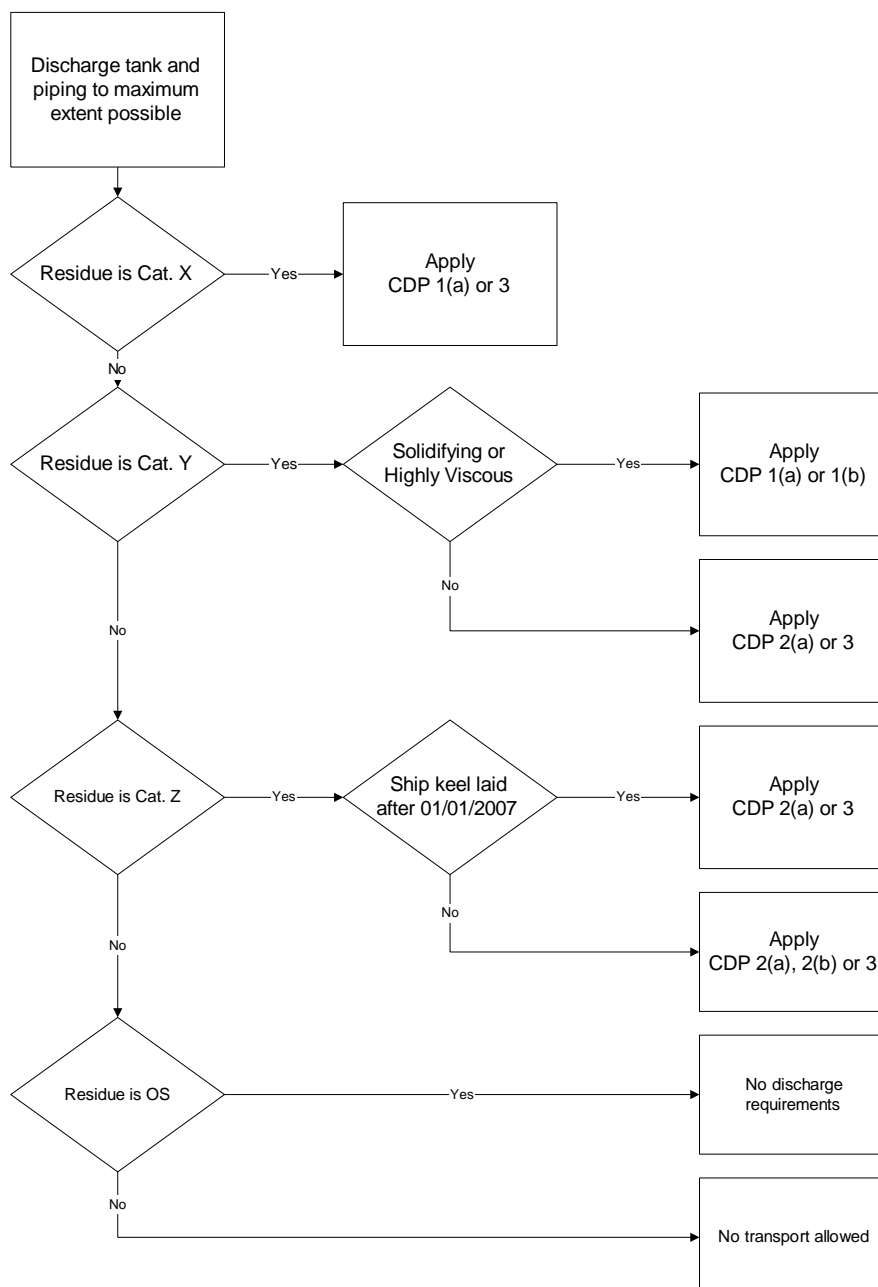
## ADDENDUM A

### Flow Diagrams – Cleaning of Cargo Tanks and Disposal of Tank Washings/Ballast Containing Residues of Category X, Y and Z Substances

Note 1: This flow diagram shows the basic requirements applicable to all age groups of ships and is for guidance only.

Note 2: All discharges into the sea are regulated by Annex II.

Note 3: Within the Antarctic area, any discharge into the sea of Noxious Liquid Substances or mixtures containing such substances is prohibited.



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Ship Details	Stripping Requirements (in liters)		
	Category X	Category Y	Category Z
New Ships: keel laid after 1 January 2007	75	75	75
IBC ships until 1 January 2007	100 + 50 tolerance	100 + 50 tolerance	300 + 50 tolerance
BCH ships	300 + 50 tolerance	300 + 50 tolerance	900 + 50 tolerance
Other ships: keel laid before 1 January 2007	N/A	N/A	Empty to the most possible extent

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<b>Cleaning and Disposal Procedures (CDP)</b>						
(Start at the top of the column under the CDP number specified and complete each item procedure in the sequence where marked)						
No.	Operation	Procedure Number				
		1(a)	1(b)	2(a)	2(b)	3
1	Strip tank and piping to maximum extent, at least in compliance with the procedures in Section 3 of this Manual	X	X	X	X	X
2	Apply prewash in accordance with Addendum B of this Manual and discharge residue to reception facility	X	X			
3	Apply subsequent wash, additional to the prewash, with: <ul style="list-style-type: none"> <li>▪ a complete cycle of the cleaning machine(s) for ships built before 1 July 1994</li> <li>▪ a water quantity not less than calculated with “k”=1.0 for ships built on or after 1 July 1994</li> </ul>		X			
4	Apply ventilation procedure in accordance with Addendum C of this Manual					X
5	Ballast tanks or wash tank to commercial standards	X		X	X	X
6	Ballast added to tank		X			
7	Conditions for discharge of ballast/residue/water mixtures other than prewash:					
	.1 distance from land > 12 nautical miles	X		X	X	
	.2 ship’s speed > 7 knots	X		X	X	
	.3 water depth > 25 meters	X		X	X	
	.4 Using underwater discharge (not exceeding permissible discharge rate)	X		X		
8	Conditions for discharge of ballast:					
	.1 distance from land > 12 nautical miles		X			
	.2 water depth > 25 meters		X			
9	Any water subsequently introduced into a tank may be discharged into the sea without restrictions	X	X	X	X	X

## ADDENDUM B

### Prewash Procedures

*This addendum to the Manual shall contain prewash procedures based on appendix 6 of Annex II. These procedures shall contain specific requirements for the use of the tank washing arrangements and equipment provided on the particular ship and include the following:*

- .1 cleaning machine positions to be used;*
- .2 slops pumping out procedure;*
- .3 requirements for hot washing;*
- .4 number of cycles of cleaning machine (or time); and*
- .5 minimum operating pressures.*

NOTE TO TEMPLATE USER: The following text is from Section B of Appendix 6 of Annex II and may be helpful in the completion of this section. The procedures are applicable for ships built on or after 1 July 1994 and recommendatory for ships built before 1 July 1994

#### Prewash procedures for non-solidifying substances without recycling

1. Tanks shall be washed by means of a rotary jet(s), operated at sufficiently high water pressure. In the case of Category X substances, cleaning machines shall be operated in such locations that all tank surfaces are washed. In the case of Category Y substances only one location need be used.
2. During washing the amount of liquid in the tank shall be minimized by continuously pumping out slops and promoting flow to the suction point. If this condition cannot be met, the washing procedure shall be repeated three times, with thorough stripping of the tank between washings.
3. Those substances which have a viscosity equal to or greater than 50 mPa.s at 20°C shall be washed with hot water (temperature at least 60°C), unless the properties of such substances make the washing less effective.
4. The quantities of wash water used shall not be less than those specified in paragraph 20 or determined according to paragraph 21.
5. After prewashing, the tanks and lines shall be thoroughly stripped.

Prewash procedures for solidifying substances without recycling

6. Tanks shall be washed as soon as possible after unloading. If possible, tanks should be heated prior to washing.
7. Residues in hatches and manholes should preferably be removed prior to the prewash.
8. Tanks shall be washed by means of a rotary jet(s) operated at sufficiently high water pressure and in locations to ensure that all tank surfaces are washed.
9. During washing the amount of liquid in the tank shall be minimized by pumping out slops continuously and promoting flow to the suction point. If this condition cannot be met, the washing procedure shall be repeated three times with thorough stripping of the tank between washings.
10. Tanks shall be washed with hot water (temperature at least 60°C), unless the properties of such substances make the washing less effective.
11. The quantities of wash water used shall not be less than those specified in paragraph 20 or determined according to paragraph 21.
12. After prewashing, the tanks and lines shall be thoroughly stripped.

Prewash procedures with recycling of washing medium

13. Washing with a recycled washing medium may be adopted for the purpose of washing more than one cargo tank. In determining the quantity, due regard must be given to the expected amount of residues in the tanks and the properties of the washing medium and whether any initial rinse or flushing is employed. Unless sufficient data are provided, the calculated end concentration of cargo residues in the washing medium shall not exceed 5% based on nominal stripping quantities.
14. The recycled washing medium shall only be used for washing tanks having contained the same or similar substance.
15. A quantity of washing medium sufficient to allow continuous washing shall be added to the tank or tanks to be washed.
16. All tank surfaces shall be washed by means of a rotary jet(s) operated at sufficiently high pressure. The recycling of the washing medium may either be within the tank to be washed or via another tank, e.g. a slop tank.
17. The washing shall be continued until the accumulated throughput is not less than that corresponding to the relevant quantities given in paragraph 20 or determined according to paragraph 21.

18. Solidifying substances and substances with viscosity equal to or greater than 50 mPa.s at 20°C shall be washed with hot water (temperature at least 60°C) when water is used as the washing medium, unless the properties of such substances make the washing less effective.
  
19. After completing the tank washing with recycling to the extent specified in paragraph 17, the washing medium shall be discharged and the tank thoroughly stripped. Thereafter, the tank shall be subjected to a rinse, using clean washing medium, with continuous drainage and discharged to a reception facility. The rinse shall, as a minimum, cover the tank bottom and be sufficient to flush the pipelines, pump and filter.

Minimum quantity of water to be used in a prewash

20. The minimum quantity of water to be used in a prewash is determined by the residual quantity of noxious liquid substance in the tank, the tank size, the cargo properties, the permitted concentration in any subsequent wash water effluent, and the area of operation. The minimum quantity is given by the following formula:

$$Q = k (15r^{0.8} + 5r^{0.7} \times V/1000)$$

where

Q = the required minimum quantity in m<sup>3</sup>

r = the residual quantity per tank in m<sup>3</sup>. The value of r shall be the value demonstrated in the actual stripping efficiency test, but shall not be taken lower than 0.100 m<sup>3</sup> for a tank volume of 500 m<sup>3</sup> and above, and 0.040 m<sup>3</sup> for a tank volume of 100 m<sup>3</sup> and below. For tank sizes between 100 m<sup>3</sup> and 500 m<sup>3</sup> the minimum value of r allowed to be used in the calculations is obtained by linear interpolation.

For category X substances, the value of r shall either be determined based on stripping tests according to the Manual, observing the lower limits as given above, or be taken to be 0.9 m<sup>3</sup>.

V = tank volume in m<sup>3</sup>

k = a factor having values as follows:

Category X, non-solidifying, low-viscosity substance, k = 1.2

Category X, solidifying or high-viscosity substance, k = 2.4

Category Y, non-solidifying, low-viscosity substance, k = 0.5

Category Y, solidifying or high-viscosity substance, k = 1.0

The table below is calculated using the formula with a *k* factor of 1 and may be used as an easy reference.

Stripping quantity (m <sup>3</sup> )	Tank volume (m <sup>3</sup> )		
	100	500	3,000
≤ 0.04	1.2	2.9	5.4
0.10	2.5	2.9	5.4
0.30	5.9	6.8	12.2
0.90	14.3	16.1	27.7

21. Verification testing for approval of prewash volumes lower than those given in paragraph 20 may be carried out to the satisfaction of the Administration to prove that the requirements of regulation 13 are met, taking into account the substances the ship is certified to carry. The prewash volume so verified shall be adjusted for other prewash conditions by application of the factor *k* as defined in paragraph 20.



## ADDENDUM C

### Ventilation Procedures

*This addendum to the Manual shall contain ventilation procedures based on Appendix 7 of Annex II. The procedures shall contain specific requirements for the use of the cargo tank ventilation system, or equipment, fitted on the particular ship and shall include the following:*

- .1 ventilation positions to be used;*
- .2 minimum flow or speed of fans;*
- .3 procedures for ventilating cargo pipeline, pumps, filters, etc.; and*
- .4 procedures for ensuring that tanks are dry on completion.*

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**ADDENDUM D**  
**Additional Information and Operational Instructions**  
**Required or Accepted by the Administration**