



Norwegian Clean Seas Association for Operating Companies  
NOFO

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Date: 1<sup>st</sup> of December 2021

## **NOFO Standard 2021**

# **Requirements for oil recovery vessels on the Norwegian Continental Shelf**

## **Preface**

The NOFO Standard is developed by the Norwegian Clean Seas Association for Operating Companies (NOFO) to ensure satisfactory safety and efficiency in oil spill response operations on the Norwegian Continental Shelf. NOFO's vision is to be a recognized, leading, efficient and robust oil spill protection organization.

The NOFO Standards are developed based on recognized standards and experience since 1978, in addition to relevant regulations and regulations deemed necessary to satisfy the requirements of the Norwegian petroleum and shipping industry.

Where relevant, the NOFO Standard can be used as the Norwegian industry's input into international oil spill response efforts.

NOFO Standards are administered and published by NOFO.

This revision replaces NOFO standard 2009, Rev. 09, May 2011.

### **Major changes include:**

- New format with function-based requirements in the NOFO standard
- New drawings of oil recovery equipment and systems
  
- Changed location requirements for fastening of NOFO equipment
- Changed requirements for stern gate design
- Changed requirements for tank heating systems
- Changed requirements for discharging ORO lines
  
- Requirements for infrared camera
- Requirements for dedicated/changed placement of tugger winch for oil recovery equipment
- Requirements for fixed hydrocarbon detection system
  
- Increased minimum tank capacity for dispersant to minimum 100 m<sup>3</sup>
- Increased ORO tank capacity to minimum 1800 m<sup>3</sup>

Rev. 01, March 2000  
Rev. 02, August 2003  
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# CHAPTER 1 INTRODUCTION AND GENERAL REQUIREMENTS

## SECTION 1 REQUIREMENTS

### 1 Introduction

#### 1.1 Purpose

1.1.1 This document specifies requirements that shall be met by all vessels built in accordance with the NOFO standard.

1.1.2 It is assumed that vessels satisfy all requirements imposed by the Norwegian authorities and by classification societies for seagoing Oil Recovery (OR) vessels.

1.1.3 Chapters 5 and 6 includes additional requirements that shall be met for OR vessels with NOFO oil recovery equipment permanently installed on board and/or OR vessels with permanently installed equipment for dispersion on board.

#### 1.2 Operational requirements

1.2.1 The vessel shall be ready for Oil Recovery Operation (ORO) within two hours after ORO tanks are discharged and cleaned (if needed).

1.2.2 In order to meet the requirements for response time, the vessel shall be able to maintain a speed of at least 14 knots in normal loading condition.

1.2.3 Preparation time of the deck area for receiving the oil recovery equipment shall not exceed one hour after any cargo has been discharged. The ship's crew shall be able to carry out the work without the use of external cranes.

1.2.4 A dynamic positioning (DP) system with minimum IMO Class 1 is required.

1.2.5 The vessel shall have sufficient resources to be able to carry out a 30-day continuous oil recovery operation, whereas five of the days are in transit at 14 knots.

1.2.6 The ship shall be designed so that all NOFO equipment shall be sea fastened in designated locations.

1.2.7 The design conditions for ORO are as follows:

- Significant wave height: 3.5 meter
- Wind speed: up to 20 m/s
- Temperature: air temperature down to -20 °C

All systems associated with ORO shall be able to operate within each of these conditions.

1.2.8 There shall be sufficient space for oil recovery equipment onboard and to facilitate safe operations during ORO, as well as to form and maintain a separation between clean and dirty zone.

1.2.9 The vessel shall satisfy the requirements set for the relevant area. For example, the Polar Code is applicable if the vessel is planned to be operate within the areas where this code applies.

#### 1.3 Current revision of the standard

1.3.1 Vessels which are keel laid after 1<sup>st</sup> of December 2021 shall follow the 2021 revision of this standard. The revision has no retroactive effect. Vessels keel laid before this date can be upgraded to NOFO standard 2021.

1.3.2 Treatment of non-conformities follows NOFO's processes. Approved deviations must be registered and noted as a comment in the certificate.

## 2 Definitions

Table 1 Definitions

<i>Feature</i>	<i>Description</i>
Aerostat	Balloon with closed-circuit television (CCTV)
Anti-icing	Measures to prevent snow and ice from forming on surfaces, structures and equipment. The intention of anti-icing is that surfaces, structures and equipment are immediately available.
Atmospheric icing	Icing caused by freezing precipitation (e.g., snow, freezing rain, freezing fog, rime frost) on ship surfaces, structures or equipment.
De-icing	Measures to remove snow and ice accumulations from surfaces, structures or equipment. The intent of de-icing is that the surfaces, structures or equipment can be made available within a reasonable amount of time.
Design phase	Vessels under construction and before the hull fabrication has commenced.
Dispersant	Liquid chemical to carry out dispersion Dispersants are used to speed up the natural degradation of an oil flake.
Dispersion	General definition: A mixture of two non-mixable phases. In relation to ORO, dispersion is an application method of mixing chemicals with oil and water. Application can be carried out from aircraft and vessels.
Dispersion equipment	Adjustable device with nozzles positioned to distribute dispersant evenly over a certain width on the outside of the ship sides.
ECDIS	The Electronic Chart Display and Information System is a computerized navigation and information system in accordance with IMO's regulations that can be used as an alternative to paper-based maps.
Environmental design conditions	The cold climate conditions for which the vessel is designed to operate. For winterization, the key design environmental conditions are air temperature, sea water temperature and wind speed.
Emulsion	Physical phenomenon in which water droplets penetrate the oil and form a viscous, stable flake with up to 80 percent water content. The ability to form emulsions varies depending on the type of oil.
Ex-zone	A zone where an explosive atmosphere is or may be present in such quantities that special requirements are required for the construction, installation and use of electrical equipment or other ignition sources.
Heavy oil skimmer	Skimmer used to recover highly viscous oil from the sea (e.g. Framo HiWax/HiVisc).
IAS	Integrated Automation System – a system on board that controls a number of the vessel's functions, such as the vessel's loading and discharging systems.
Nozzle	Equipment that with the help of pressure converts liquid into a cloud of droplets.
Oil boom	Physical barrier used to recover and concentrate oil on the surface to facilitate recovery with OR equipment
Oil skimmer crane	Technical lifting device for lifting the oil skimmer between the deck and the sea

Oil skimmer	Equipment used to transfer oil from the sea to the oil recovery vessel
Oil Spill Detection (OSD) radar	Radar that can detect areas where ripples on the sea surface are dampened due to oil.
Oil spill response vessels	Vessels that satisfy the regulations on "Vessels used in oil recovery operations" and are equipped for and approved by the Norwegian Maritime Administration (NMA) for the towing of oil recovery equipment.
OR vessels	Oil Recovery vessels that hold "Oil Recovery" class notation and meet the requirements described in this NOFO Standard.
Overflow skimmer	Skimmer used to recover lightly viscous oil from the sea.
Sea spray icing	Icing caused by the freezing of sea spray on ship surfaces, structures and equipment.
Standby vessels	Emergency preparedness vessels approved by the Norwegian authorities to cover the emergency preparedness for several installations in one area. The vessel shall have "Oil Recovery" class notation and meet the requirements in the NOFO standard when it has NOFO's oil recovery equipment permanently installed on board.
Steam nozzles	Nozzles for transporting steam directly into liquid for heating.
System index	Index indicating tank capacity for accumulated oil emulsion on a NOFO OR vessel. For example: Tank capacity 1500 m <sup>3</sup> provides system index 1.5. Tank capacity 2300 m <sup>3</sup> provides system index 2,3. etc.
Tank capacity	The recovered oil/oil emulsion storage capacity of an OR vessel
Thermal capacity	Factor used in power calculations for heating of liquids. In this standard, a heat capacity of 3.44 kJ/kg/°C shall be used for a 50% mixture of oil and water.

### 3 Procedural requirements

#### 3.1 Documentation requirements

Documentation shall be provided electronically (AutoCad, DWG) in addition to 3D drawings as shown in Table 2.

**Table 2 Documentation requirements**

<i>Feature</i>	<i>Type of documentation / Description</i>	<i>Additional description</i>
Stern gate	Drawing Stern gate arrangement/system	Drawing showing the dimensions of the stern/stern gate opening, clearances and rounded stern
Deck anchoring points	Drawing Main deck arrangement for oil recovery equipment	Anchoring points on deck for NOFO equipment.
ORO filter	Drawing ORO filter details	Details of filters, covers and locations on deck to demonstrate availability. Theoretical capacity shall be stated.
GA plan	Drawing A general arrangement plan showing the layout of the various deck equipment in relation to the vessel.	
GA plan for oil recovery equipment	Drawing A general arrangement drawing showing the overview of the deck equipment on the ship, including the oil recovery equipment.	Deck anchoring points for NOFO equipment including strength calculations.  Overview of deck arrangement which will require preparation time for mobilization.
Clearances	Drawing  Oil skimmer crane	Clearances to cargo rail to enable the launching and recovery of skimmers.
Hydraulic diagram	Drawing / diagram The hydraulic system related to NOFO equipment	Capacity calculations for discharge arrangements including calculation of pressure loss in pipe arrangements.
Lighting arrangement	Drawing Lighting arrangement plan	Location and touch area of deck lights for safe handling of oil recovery equipment.
Manifold arrangement	Drawing Main deck arrangement for oil recovery equipment	Location of manifold, hydraulics, discharge/loading pipes connections and electrical power supply outlets, etc.
Platform	Drawing Platform arrangement for oil skimmer crane	If applicable

ORO pumps	Pump specification	Including details of capacity, pressure and pressure loss on the suction side for oil collection pumps.
Piping system	Drawing/Diagram ORO pipes including load line/discharge line	Capacity calculations for the discharge system, including calculation of pressure loss in the piping system.
Tank plan	Drawing Overview ORO tanks	Capacities/volumes shall be included.
Tank heating system	Drawing Tank heating system	Heat capacity calculations for ORO tanks shall be included.

## 4 References

References to other relevant documents can be found in Table 3.

**Table 3 References**

<i>Reference</i>	<i>Title</i>
NORSOK	NORSOK L – Piping and Layout – Pipe System and Floor Plan
DNV	Part.6, Ch.5, Sec. 11 Recovered oil reception and transportation (OILREC)

## 5 Abbreviations

Abbreviations can be found in Table 4.

**Table 4 Abbreviations**

<i>Element</i>	<i>Info</i>
BV spray	Boom Vane Spray
DP	Dynamic Positioning
ECDIS	Electronic Chart Display and Information System
HPU	Hydraulic Power Unit
IAS	Integrated Automation System
OSC	On scene commander
IMO	International Maritime Organization
IR camera	Infrared Camera
ISO	International Organization for Standardization
MBR	Maritime Broadband Radio
MOB boat	Man-overboard boat
MOS sweeper	Marine Oil Spill Sweeper
NAS	National Aerospace Standard
OR vessel	Oil Recovery Vessel
ORO	Oil Recovery Operations
SWL	Safe Working Load

## CHAPTER 2

# HULL AND OUTFITTING REQUIREMENTS

### SECTION 1

## Tanks in Oil Recovery Operations

### 1 ORO tank capacity

#### 1.1 General

1.1.1 The standard is intended to set minimum requirements.

1.1.2 Efforts shall be actively made to achieve largest possible tank capacity. The minimum tank capacity for storage of collected oil is 1800 m<sup>3</sup>.

#### 1.2 Tanks to be considered for ORO tank capacity

1.2.1 The following tanks should be considered for in ORO tank capacity:

- Mud tanks
- Ballast tanks
- Brine tanks
- Slop tanks
- Methanol tanks
- Special product tanks
- Staff tanks
- Chain boxes
- Fuel tanks

1.2.2 Methanol and special product tanks shall be specially considered, and necessary arrangements shall be made to make these available in the event of use during ORO.

#### 1.3 Tanks not to be used in ORO tank capacity

The following tanks should not be included in ORO tank capacity:

- Wing tanks, bottom tanks and other tanks with a lot of internal structure
- Fresh water tanks
- Tanks with a volume less than 50 m<sup>3</sup>

#### 1.4 ORO tank access

1.4.1 It should be possible to access all ORO tanks from deck via manhole with a minimum 600 x 800 mm opening.

1.4.2 Manholes should provide access for cleaning of tanks and for installing scaffolding.

1.4.3 The location of manholes should be such that it is possible to set up temporary scaffolding installations.

1.4.4 All ORO tanks, with the exception of methanol and special product tanks, shall be equipped with inspection hatches to facilitate inspection and measurement. The inspection hatch shall as a minimum have a nominal diameter (ND) of 150 mm.

## **1.5 Cleaning**

1.5.1 Cleaning shall be taken into consideration when designing the vessel. Pumps and piping systems shall be designed for easy access, dismantling and cleaning. Pipes shall be arranged to be blown empty in the case of cleaning.

1.5.2 There shall be permanently installed washing arrangement in tanks where this is practically possible for coarse cleaning of ORO tanks.

## **1.6 Fuel tanks capacity**

1.6.1 The fuel tanks shall have sufficient capacity to meet the operational requirements of Chapter 1, Section 1.

1.6.2 If some fuel tanks are connected to the ORO system, these cannot be included in the fuel capacity.

1.6.3 It shall be possible to refill the fuel tanks under ORO. The dimensions and connections shall comply with NORSOK Standard.

## **1.7 Freshwater tanks capacity**

1.7.1 The freshwater tanks shall have sufficient capacity to meet the operational requirements of Chapter 1, Section 1.

1.7.2 In addition to general consumption, consumption shall also be included for tank heating if the system has a consumption of fresh water.

1.7.3 It shall be possible to refill the consumption tanks under ORO. The dimensions and connections shall comply with NORSOK Standard.

## **2 ORO tank heating requirements**

### **2.1 Heat capacity**

2.1.1 All ORO tanks shall be equipped with a permanent arrangement for heating collected oil and oil emulsion.

2.1.2 The choice of heating systems shall be adapted to the respective tank systems. A heat source shall be located near the suction line of the tank.

2.1.3 It shall not be necessary to access the tank to prepare the tank heating system for ORO.

2.1.4 Documentation for heat source and heating procedures shall be included as part of the ORO manual.

2.1.5 The tank heating system shall be documented to be efficient for heating oil and oil emulsions, including high viscosity oils.

2.1.6 The arrangement shall enable a temperature increase of 15 °C for a volume of 1800 m<sup>3</sup> over 12 hours; assuming a sea temperature of 5 °C and air temperature of 0 °C.

2.1.7 In the calculations, specific heat capacity is set to 3.44 kJ/kg/°C as the typical value for a 50% mixture of oil and water.

2.1.8 It shall be possible to utilize the entire heat source capacity at the same time on any combination of a maximum of three tanks.

## SECTION 2 ORO DECK OUTFITTING

### 1 Deck arrangement

#### 1.1 Introduction

1.1.1 This section describes the general arrangement, ship-specific deck equipment, deck fastening and connection points for oil recovery equipment installed on deck.

1.1.2 The design of the vessel shall enable and facilitate operations involving the oil spill detection, collection and dispersion, either simultaneously or separately. The event shall have flexibility for different ORO scenarios and different types of equipment.

1.1.3 The deck arrangement shall have clear boundaries between the dirty zone (NOFO work area) where the oil recovery equipment is located and clean zone (cargo area) that can be used for other purposes.

1.1.4 All equipment shall be placed at sufficient distances to surrounding barriers to enable natural turning on connected hoses – for hydraulics, air, etc.

1.1.5 The area between the stern gate and NOFO equipment shall be able to be flushed every time the stern gate is open.

#### 1.2 Deck arrangement

1.2.1 This section covers the requirements related to different NOFO oil recovery equipment and the main deck arrangement.

1.2.2 Details related to the location, clearance, clamping zones and strength of the various deck fastenings are shown in Table 5, Figure 1, and Appendix B.

Table 5 Deck Arrangement

No.	Requirements for fastening	Fastening clearance	Conventional oil boom and oil skimmer crane (TransRec 150 Norlense 1200R)	Single boat system (MOS Sweeper 50)	Deployable dispersion (BV Spray system)
1	20' container anchoring points	1000 mm	Oil boom drum	-	-
2	20' container anchoring points	1000 mm	Oil boom drum	-	-
3	20' container anchoring points	1000 mm	Oil boom drum	Sweeper drum	-
4	20' container anchoring points	600 mm	Wash container	Wash container	Wash container
5	20' container anchoring points	600 mm	-	-	Dispersion/BV Spray
6	20' container anchoring points	600 mm	Workshop container	Workshop container	Workshop container
7	20' container anchoring points	600 mm	-	Paravane	Paravane
8	Strap fasteners	-	Overflow skimmer	STS transfer	STS transfer
9	Strap fasteners	-	Heavy oil skimmer	STS transfer	STS transfer
10	20' container anchoring points	See Appendix B	Oil skimmer crane	Lifting device	Lifting device

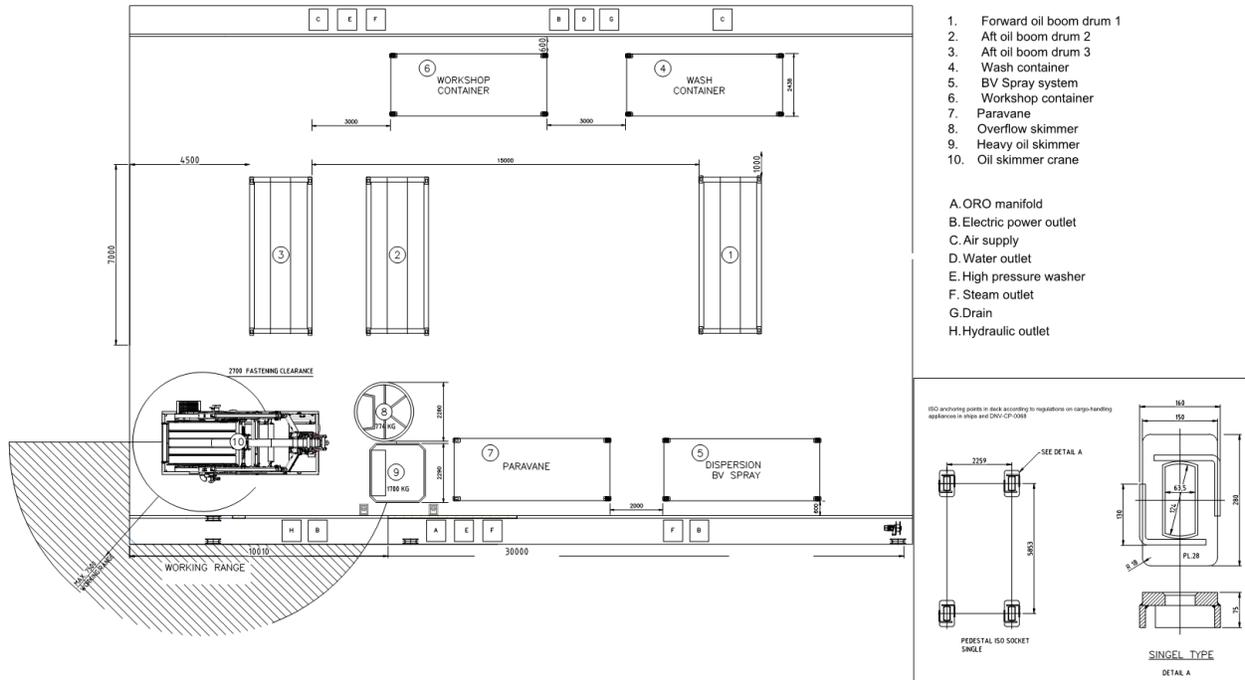


Figure 1 Deck arrangement

**1.3 Stern gate in transverse rail**

- 1.3.1 On vessels that have a transverse rail astern, there shall be a stern gate for launching the oil boom. The gate shall be simple to operate and free from obstructions when open.
- 1.3.2 Minimum opening is 7000 mm wide and 2500 mm high for launch/recovery of the oil boom over the stern.
- 1.3.3 The opening shall be free from all sharp edges, reinforcements, bolts, hydraulic cylinders, limit switches and any other elements that may damage or catch the oil boom during launching or recovery.
- 1.3.4 It shall be possible to open and close the gate with oil recovery equipment located in their anchoring points.
- 1.3.5 The gate opening shall be centered behind the fastening point for the oil boom.
- 1.3.6 Opening and closing shall be done hydraulically, and the gates shall be mechanically secured in the open position.
- 1.3.7 If the gate is bottom hinged, the gate shall be flush with main deck when open, without sharp edges or openings entangling the boom or its ropes.
- 1.3.8 When gates are in the open position, a temporary protection against falling overboard shall be arranged.

**1.4 Cargo rail height near oil skimmer crane**

- 1.4.1 The aft starboard cargo rail height in way of the defined working area for the oil skimmer crane can maximum be 2500 mm. This is to enable launching and retrieving of the skimmer. (See Appendix B).
- 1.4.2 If the cargo rail height starboard aft exceeds 2500 mm, the cargo rail shall be reduced in height in the defined working area, or a platform shall be assigned.
- 1.4.3 The platform can be “removable” but shall be permanently mounted (welded or bolted) when the vessel is part of NOFO's standby fleet or to maintain a valid NOFO certificate.

1.4.4 The platform can also be movable; recessed in main deck and hydraulically liftable and hydraulically lockable at the proper height. In addition to hydraulic locking, there shall be means of mechanical locking to ensure safe usage.

1.4.5 The platform shall withstand a static load of 20 tons.

1.4.6 The platform shall be able to support the TransRec150 equipment with associated skimmers. (See Appendix B for details)

1.4.7 The platform shall be at least 8000 mm long and 5400 mm wide with railing according to regulatory requirements.

1.4.8 The platform shall be arranged with openings/recesses without sharp edges so that hydraulic and cargo hoses have a natural run down towards the main deck without causing unnecessary bends in the hoses.

## **1.5 Deck layout and secure work area**

When designing the NOFO work area, emphasis shall be placed on anti-slip protection, avoiding the risk of crushing/pinching injuries, exposure to open sea and weather conditions.

## **2 Anchoring points**

### **2.1 Anchoring points for oil recovery equipment**

2.1.1 The vessel shall have permanent anchoring points for all NOFO equipment installed on deck.

2.1.2 The anchoring points shall be able to accommodate 20' standard containers. (See Appendix B)

2.1.3 When placing oil recovery equipment, there shall be a distance of at least 600 or 1000 mm in accordance with Table Table 5 for safe operation and access for maintenance between the vessel's installations and the oil recovery equipment.

2.1.4 The anchoring points shall be protected against contact damage when not in use.

2.1.5 The anchoring points shall have a SWL of at least 25 tons.

### **2.2 Oil skimmer crane**

2.2.1 The vessel shall have permanent anchoring points for the oil skimmer crane on the starboard side aft of the vessel, for launching and retrieving the skimmer. The skimmers can be located on the main deck or on the same platform. (See Appendix B)

2.2.2 The anchoring points shall have 20' standard container fastening.

2.2.3 The anchoring points shall be dimensioned for a weight of 20 tons, as well as a SWL of 3 tons at 7.5 m.

### **2.3 Oil boom drum**

2.3.1 The vessel shall have permanent anchoring points for the oil boom drum centered in front of the vessel's stern gate. (See Appendix B)

2.3.2 The anchoring points shall have 20' standard container fastening.

2.3.3 The anchoring points shall be dimensioned for a weight of 30 tons and a horizontal force of 14 tons acting at a height of 3.5 m.

### **2.4 Barrier towards cargo area**

The vessel shall be arranged for setting up a barrier in front of the NOFO work area in order to separate the NOFO work area and the remaining part of the cargo area. The purpose is to protect oil recovery equipment and personnel in the NOFO work area from the remaining part of the cargo deck that can be used for cargo.

### **3 Arrangement for towing of boom systems**

#### **3.1 Towing arrangements**

3.1.1 Arrangements for hauling in, tightening and fastening the main tow connection shall be arranged.

3.1.2 A bollard, a capstan and a fairlead with SWL 25 tons shall be provided on starboard side aft of the main deck.

3.1.3 The fairlead shall be approx. 10-15 m from the transom.

3.1.4 Bollard placed in the recess in the ship's side, as a combination of fairlead and bollard, can be accepted.

#### **3.2 Transverse towropes**

3.2.1 Arrangement to handle transverse towropes shall be assigned.

3.2.2 Winch and fairlead shall be assigned on the main deck in cargo rail on starboard side approx. 30 meters from the transom.

- Minimum SWL of winch: 10 tons.
- Rope: Fiber material, minimum SWL 10 tons, safety factor 3, maximum weight 25 kg/100m.

3.2.3 The winch shall have camera surveillance from the bridge. Screen shall be visible from the main maneuvering position in ORO, normally at aft navigation console.

3.2.4 The winch shall be able to be operated remotely from the bridge in addition to local control. Remote control on bridge shall be placed at the main maneuvering position in ORO, normally at aft navigation console.

#### **3.3 Towropes on bow**

3.3.1 Arrangement that enables the towing of paravane from bow shall be assigned.

3.3.2 The arrangement should be assigned to allow towropes on the starboard side to be used. The vessel may have its own winch. Alternatively, mooring/anchor winch arrangements can be adapted and used.

- Minimum SWL of winch: 10 tons.

3.3.3 The winch shall have camera surveillance from the bridge. Screen shall be visible from the main maneuvering position in ORO, normally at aft navigation console.

3.3.4 The winch shall be able to be operated remotely from the bridge in addition to local control. Remote control on bridge shall be placed at the main maneuvering position in ORO, normally at aft navigation console.

## **SECTION 3 MISCELLANEOUS**

### **1 Cabin capacity**

#### **1.1 Cabin capacity**

- 1.1.1 The vessel shall have a minimum of 10 berths for NOFO's oil spill response personnel.
- 1.1.2 It shall maximum be two berths in each cabin.

### **2 Wheelhouse**

#### **2.1 Wheelhouse - cable penetration**

- 2.1.1 The wheelhouse shall have a minimum of one cable duct with a 3" opening for external down-link antenna cables for mobilizable equipment.
- 2.1.2 The duct shall be located between the aft navigation console and the door on the starboard bridge wing with easy access to the duct from both the inside and the outside.
- 2.1.3 Connector for 230V outlet shall be location in the same area.

#### **2.2 Fixed UHF**

The vessel shall have fixed UHF on the bridge and in the engine control room. In addition, the vessel shall have portable Ex proof UHF communication equipment for the deck crew. NOFO operating frequency 416.5375 MHz shall be programmed.

### **3 Speed log**

The vessel shall be equipped with a log for measuring relative speed between water and vessel.

## **CHAPTER 3 SYSTEM REQUIREMENTS**

### **SECTION 1 GENERAL REQUIREMENTS**

#### **1 Operational requirements**

##### **1.1 General**

1.1.1 The vessel shall have sufficient power supply, water supply, pressure for hydraulics and pneumatics and sufficient spare parts to carry out a 30-day continuous oil recovery operation.

1.1.2 Sufficient power outlets/cabinets shall be available within the NOFO work area and within the cargo rail to have as short a connection as possible to different deck equipment. (See Appendix B)

1.1.3 The vessel shall have the ability to effectively separate water from recovered oil, load recovered oil to the tanks and discharge separated water overboard on the starboard side.

1.1.4 It shall be possible to carry out loading and discharging simultaneously during ORO.

1.1.5 The vessel shall have the ability to effectively discharge recovered oil.

1.1.6 All system connections – hydraulics, pneumatics, manifold, electrical etc. shall be located within the dirty zone/NOFO work zone within the cargo rails.

## SECTION 2 SPECIFIC REQUIREMENTS

### 1 Discharge and loading system

#### 1.1 Discharge and loading

1.1.1 The system shall have the necessary flexibility to operate in different ORO scenarios. The system shall provide sufficient tank capacities, sufficient pump capacities including pumping of oil/emulsions, and the piping system shall enable circulation within the tanks.

1.1.2 The tanks shall be sufficiently heated to ensure that oil/emulsions have sufficiently low viscosity and is always dischargeable.

1.1.3 The loading line shall be permanently equipped with duplex filter located in the cargo rail. The piping system shall enable circulation of the volume in individual tanks without having to interrupt loading/discharging of other tanks.

1.1.4 The need for heat tracing of the suction line between tank and pump should be considered to limit pressure loss when discharging viscous oils.

1.1.5 During oil recovery operations, it will be necessary to discharge separated seawater from the ORO tanks back to the oil boom. The discharge shall be arranged on starboard side above the waterline.

1.1.6 The vessels shall have the option to combine its cargo system (pumps and pipes) with its ORO loading/discharging system (pumps and pipes)

1.1.7 All segregations that need to be opened or closed to prepare the piping system for ORO shall be of the blind flange valve type.

1.1.8 Blind flange valve housings shall be easily accessible, clearly marked with signal yellow color, and marked whether they should be open or closed in ORO. Blind flange valves shall be stored in the immediate vicinity of the valve housing.

#### 1.2 Discharge capacity

1.2.1 The vessel's discharge arrangement (pumps/piping) shall satisfy the following requirements for total delivery capacity for outlets on deck:

- Minimum 500 m<sup>3</sup>/hour vs. 3 bar at 3,000 cSt viscosity, and
- Minimum 300 m<sup>3</sup>/hour vs. 7 bar at 3,000 cSt viscosity

1.2.2 The discharge capacity should be achieved by simultaneous discharging of no more than half of the tanks.

1.2.3 The discharge capacity shall be supported by theoretical calculations accounting for pressure drops in the piping system to deck level and are to be based on documented capacities for the pumps.

1.2.4 The discharge capacity should be verifiable by testing.

#### 1.3 Pumps

1.3.1 Pumps used shall be documented as suitable for oil/emulsions.

1.3.2 Single pumps shall not have a capacity less than 100 m<sup>3</sup>/hour. All pump capacity figures shall be documented at a viscosity of 3,000 cSt.

1.3.3 Pumps used for discharge of recovered oil may be arranged as submerged pumps, or connected to the tank with a short suction pipe. If the pressure drop on the suction side is less than 0.5 bar when discharging 3,000 cSt oil, one pump may serve two closely located tanks.

#### 1.4 Valves

Switching between tanks during loading/discharging should be possible using remotely operated valves.

## 1.5 Manifold

1.5.1 The loading and discharge pipes to/from the tanks shall be connected to a manifold located on main deck within the dirty zone, approximately 15 m from the vessel's transom on the starboard side. (See Appendix B)

1.5.2 Vessels arranged with a platform for the oil skimmer crane shall ensure that there is space for connection of the loading hose and that the hose has a natural run, without sharp bends, down towards the main deck.

1.5.3 The arrangement of manifold and piping system shall allow loading and discharging at the same time. Separated seawater shall be discharged through fixed piping on starboard side above the waterline.

1.5.4 Loading and discharging lines to/from ORO tanks shall be separate, but in addition be connected by a cross-over near the manifold on the main deck.

1.5.5 All ORO lines shall have a minimum of 200 mm (8") internal diameter.

1.5.6 ORO connections shall be of the type 6" Weco union, female connection, wp 1000/69 psi/bar. The coupling shall be bolted to the ORO pipe with flanges.

1.5.7 A drip tray with drainage shall be arranged below the manifold.

## 1.6 Filters

1.6.1 The vessel's loading line shall be equipped with a fixed, double filter arrangement.

1.6.2 The filter box shall be equipped with a quick-lock for easy cleaning of filter.

1.6.3 Filter capacity per filter shall be a minimum of 700 m<sup>3</sup>/hour at 3,000 cSt.

1.6.4 A drip tray with drainage shall be arranged below the ORO filter.

1.6.5 Pressure drop over the filter arrangement shall be less than 0.5 bar. Manometers shall be mounted on both sides of the filter to monitor pressure drop.

## 2 Electric power supply

### 2.1 Electric power supply

2.1.1 Power outlets shall be located on the inside of the cargo rail on port and starboard side inside the dirty zone. (See Appendix B)

2.1.2 Each side of the vessel shall have the following outlets as a minimum:

- 4 outlets 1 - phase 230V/16A  
CEAG outlet 1 - Phase - 16A/230V Eex-de **(Blue)** - GHG 5114306 R0001
- 2 outlets 3 - phase 440V/32 A  
CEAG outlet 3 - Phase - 32A/380/440 Eex-de **(Red)** - GHG 5124406 R0001

2.1.3 Outlets shall be placed in tight stainless steel cabinets marked "NOFO". It shall be possible to close the door when cables are connected.

## 3 Air supply system

### 3.1 Air supply to power tools

Compressed air outlets for operation of tools/equipment shall be located within the cargo rails in the dirty zone, on both sides of the vessel.

### 3.2 Air supply to oil boom

3.2.1 The outlets shall be placed in the port side cargo rail by the aft oil boom winch. (See Appendix B)

3.2.2 The compressed air system on deck shall have a capacity of at least 5 m<sup>3</sup>/min at 6 bar.

- 1 x Quick snap Type Hansen connection (female) ½"
- 2 x Camlock connection (female) 1½"

- 1 x Claw coupling 1", European standard with the possibility of safety pin

3.2.3 There shall be 100% reserve capacity in the vessels compressed air system. The compressed air system on deck shall be supplied from minimum two independent sources each with a capacity of 100% of the minimum required capacity.

3.2.4 The air supplied to the deck shall be free from moisture.

## 4 Steam, water and wastewater systems

### 4.1 Water outlets

Water outlets shall be placed within the port side cargo rail in the dirty zone at the anchoring point for wash container. (See Appendix B)

- Claw coupling 1", European standard with the possibility of safety pin

### 4.2 High pressure washer with lance

Outlets for high pressure washers shall be placed within the cargo rail in the dirty zone, on the starboard and port side at the aft oil boom winch and anchoring point of the oil skimmer crane. (See Appendix B)

- ERGO connection (female), 3/8"
- Minimum 160 bar
- Capacity of 1200 liters per hour
- Minimum temperature 80 °C
- Lance with 25 m hose

### 4.3 Steam outlet with lance

Steam outlets shall be placed within the cargo rail in the dirty zone, on the starboard and port side at the aft oil boom winch and anchoring point of the oil skimmer crane. (See Appendix B)

- ERGO connection (female), 3/8"
- Outlet from steam valve, 1"
- Pressure: 5 bar
- Temperature: 140°C
- Lance with 1" steam hose - minimum 25 m

### 4.4 Washing water drain from wash container

A connection shall be placed within the cargo rail in the dirty zone on the port side by the wash container anchoring point. (See Appendix B)

- Camlock connection (male) 1½"

## 5 Hydraulic power systems

### 5.1 Hydraulic outlets and couplings

5.1.1 Hydraulic outlets from the vessel's hydraulic system shall be placed within the starboard side cargo rail approx. 10 m from the transom. (See Appendix B)

5.1.2 The high-pressure pipe shall be fitted with a pressure gauge/manometer and a shut-off valve.

5.1.3 All hydraulic couplings on board shall be acid-proof female couplings.

- The high-pressure piping shall be routed to two outlets with the following 1¼" connections:
  - Snap Tite S71-3C16-20RP with sleeve lock
- The return piping shall be routed to two outlets with the following 1½" connections:

- Tema - Flat face FF10010 - 150 RV
- The drain piping shall be routed to two outlets with the following ½" connections:
  - Tema 5010 RV

## 5.2 Capacity and reserve capacity

5.2.1 For continuous operation of the oil recovery equipment, the following two capacity requirements shall be satisfied at deck outlets:

- 295 liters per minute at 280 bar – Return: <5 bar, Leak: <1 bar
- 390 liters per minute at 240 bar – Return: <5 bar, Leak: <1 bar

Capacities shall be documented with calculations.

5.2.2 The system shall have a minimum reserve capacity of 50%. For example: If the total capacity is delivered by two pumps, there shall be a third pump that delivers 50% of the total capacity.

5.2.3 The system shall have cooling arrangements for the hydraulic oil to prevent overheating during continuous operations.

5.2.4 Return pipes shall have a minimum of 50 mm inner diameter to ensure a low pressure drop.

## 5.3 Hydraulic oil quality

5.3.1 Oil quality ISO 4406 17/15/12 or better (replaces NAS 6). Tested annually with submission of test results to NOFO.

5.3.2 Hydraulic oil type:

- Group II Mineral based oil
- SHELL TELLUS S2 VX 46 or equivalent

## 6 Bridge systems

### 6.1 Oil spill detection radar

6.1.1 The vessel shall have a permanently installed oil spill detection radar providing automatic detection of oil. The ability to detect oil shall be documented.

6.1.2 The radar shall show "real-time" oil detection, be able to determine both size and position of the oil spill, drift trajectory history, as well as estimation of drift speed and direction. The system shall also provide information on wind direction and speed.

6.1.3 Radar image shall be visible from the main forward navigation position, main aft navigation position and the ILS workstation.

### 6.2 Infrared camera

6.2.1 The vessel shall have a permanently installed infrared camera with documented oil detection ability.

6.2.2 The camera shall show "real-time" oil detection, be able to present both size and position of the oil spill, drift trajectory history, as well as estimation of drift speed and direction. The system shall also provide information on wind direction and speed.

6.2.3 The camera image should be visible from the main forward navigation position, main aft navigation position and the ILS workstation.

6.2.4 The camera shall be located on starboard side on top of the wheelhouse, without any obstacles in the 270 degrees operating area: from port 90, straight forward, starboard 90, straight aft, including the entire oil boom area. (See Appendix C and D)

### **6.3 IAS**

It shall be possible to present the ORO system in a separate module in the IAS system on bridge and in engine control room.

### **6.4 OCS workstation**

A dedicated workstation for the on-scene commander (OSC) shall be arranged with the following specification for efficient management of an oil recovery operation:

- Work desk with chair
- Minimum two screens with access to display and operate:
  - Navigation radar (passive access only)
  - Electronic Chart Display and Information System (ECDIS)
  - Oil spill detection radar
  - Infrared camera
  - Computer with internet, e-mail, spreadsheet and word processing, etc.
  - MBR (Maritime Broadband Radio, applies only for vessels with NOFO oil recovery equipment permanently installed on board)
- Two connection points for data communication/internet
- Six 230V 60Hz power outlets
- Telephone with minimum two telephone lines (Mobile phone/satellite)
- One VHF
- Whiteboard

### **6.5 Dedicated area for remote monitoring equipment**

6.5.1 A dedicated area for remote monitoring equipment shall be located on starboard side on top of the wheelhouse, without obstacles in the 225 degrees operating area: from 45 degrees towards port side, straight forward, starboard 90 degrees, straight aft, including the entire oil boom area. (See Appendix C and Appendix D)

6.5.2 The area shall have the possibility to install multiple sensors.

6.5.3 The equipment is limited to a height of 2 m and a total weight of 500 kg.

6.5.4 The area shall have four outlets for 230V 60 Hz power supply.

6.5.5 A signal cable duct shall be installed from the remote monitoring equipment area to the bridge. The minimum diameter of the duct shall be 3".

### **6.6 Bracket for communication antennas**

6.6.1 A dedicated bracket for MBR (Minimum Broadband Radio) antennas shall be located on each sides of the top of the wheelhouse. The brackets shall be arranged to provide a free line of sight 180 degrees horizontally so that they together provide 360 degrees clear view, as well as 60 degrees vertically.

6.6.2 Minimum distance to the VHF antenna should be 1.5 m. Each bracket shall have a surface of 0.5 x 0.5m with several holes for mounting antennas with weight less than 100 kg. It shall be possible to run antenna cables to the bridge.

### **6.7 Remote monitoring equipment position on the bridge**

6.7.1 An open area of approx. 500 x 400 mm shall be available at each navigator and maneuvering position to enable the placement of remote sensing consoles. These may be folding tables positioned below the windows on the bridge, or tables on top of other equipment consoles

6.7.2 The navigator shall be able to monitor this equipment while maneuvering the vessel during ORO.

6.7.3 There shall be a 230V 60Hz outlet nearby.

## **6.8 Internet connection**

6.8.1 The vessel shall have internet coverage on the entire Norwegian Continental Shelf and in the northern areas with low satellite elevations. Coverage can be achieved with several different types of technologies, including GSM and satellite-based technologies.

6.8.2 Minimum bandwidth of 1024 Mbits shall be available under ORO. A dedicated "NOFO operation mode" should be established to ensure that NOFO has priority on bandwidth during operations.

6.8.3 All satellite equipment should have two-way communication.

## **7 Safety systems**

### **7.1 Protection against falling overboard**

When open gates are required during ORO, temporary measures against falling overboard shall be arranged.

### **7.2 Lighting on deck**

The entire NOFO work area shall have sufficient working light (minimum 100 lux) with relevant Ex certification. The area around and behind the oil skimmer crane and oil boom drum are particularly important in this regard.

### **7.3 MOB boat**

The vessel shall be equipped with a MOB boat located in a davit on the port side.

### **7.4 Fixed hydrocarbon detection system**

The vessel shall have a fixed system for detection of hydrocarbons in ORO mode. Number and location of measuring points according to class notation for Oil Recovery. Minimum, but not limited to, detection in bridge wing/mast area and defined Ex-zones in main deck dirty zones.

## CHAPTER 4 OPERATION IN COLD CLIMATE

### SECTION 1 GENERAL

#### 1 Requirements for operation in cold climates

##### 1.1 Introduction

1.1.1 Oil recovery operations in cold climates will require a minimum of winterization of both vessels and equipment. The winterization shall be adapted to the vessel and equipment in question so that it is able to efficiently carry out ORO under the climatic conditions that may arise in the planned geographical operating area. These conditions will vary with the season, from year to year and depend on local conditions. It is therefore important that the climatic parameters for the area in question are identified and specified as a starting point for the necessary winterization.

##### 1.2 Purpose

1.2.1 Requirements for vessels and equipment built in compliance with NOFO Standard 2021 shall ensure the ship's normal operation and the availability of oil recovery equipment stored on board and that the vessel's tasks can be carried out in a manner that ensures the safety of vessels, equipment and crew.

1.2.2 The winterization shall ensure that the vessel is capable and prepared for operations under the specified conditions. Conditions to be taken into account are minimum temperatures in air and water, risk of icing, freezing and sea ice, hereinafter referred to as *cold climate*.

##### 1.3 Guidelines for winterization

1.3.1 Design of vessels and equipment together with various winterization measures on board shall ensure a safe and efficient ORO in cold climates. This applies to all functions, systems and equipment essential for ORO. In addition, the measures shall ensure the vessel's operation, the safety of the crew and internal polluting discharges from the vessel.

1.3.2 The winterization measures include:

- Protection of important ship functions, systems and equipment
- Essential additional equipment and supplies
- Implementation of procedures for safe operation and personnel welfare in cold climates

##### 1.3.3 De-icing measures

The standard requires all NOFO vessels to be equipped with basic de-icing capacity to support the operation of NOFO equipment and ensure safe and efficient oil recovery operations in cold climates. De-icing means measures to remove snow and ice after it has accumulated on deck and equipment. De-icing can be ensured by permanently installed heating, usually by the use of electric heating cables, or by the use of portable equipment.

The most common forms of manual and portable equipment are:

- Steam
- Flushing with hot high-pressure water

De-icing can also be done manually with equipment such as shovels, clubs, sledgehammers, etc. Equipment used for manual snow and ice removal shall be used with great care to not damage the equipment to be de-iced. Therefore, vessel equipment or systems exposed to icing should also be adequately protected from mechanical damage from manual de-icing activities or water

ingress from water/steam de-icing (for example, pipes, valves, sensors, counters, switches and electrical couplings).

#### 1.3.4 Anti-icing measures:

Anti-icing is generally preferable to de-icing. Anti-icing means measures taken to prevent snow and ice from forming on surfaces, structures or equipment, whereas de-icing means measures taken to remove snow and ice after it has accumulated. The best method to protect the equipment from weather and wind is to store it indoors in a heated and dry environment, or alternatively outdoors protected with tarpaulin. The advantage of indoor temperate storage is that you also avoid freezing any residues of water, as well as avoiding plastic and rubber becoming less manageable when storing outdoors at low temperatures.

Anti-icing in the form of heating (electric heating cables or circulation of heated liquid in pipes) are also commonly used methods. The disadvantage is that a lot of energy is required, as it is difficult to design this type of system in a way that prevents significant losses to the surroundings. When dimensioning, the heating capacity of the anti-icing systems should be sufficient to prevent ice formation at an ambient temperature of -20 °C.

**Table 6 Guidelines for winterization**

<i>NOFO Standard Ref. [Chapter. Section]</i>	<i>System / Equipment</i>	<i>Winterization measures Shall include:</i>
3.2	Air supply system	- a solution for air drying in the compressed air system, sufficient to lower the dew point to -25°C or colder at the actual pressure, to prevent condensation and freezing.
4.1	Anti-slip on deck for personal safety	- a solution to remove ice and snow from deck and grating with hot water, steam or other mechanical means.
3.2	Camera, IR Camera	- a solution for protecting cameras from icing.
5.1	Wardrobe between clean and dirty zone	- a solution with hot water or steam to remove ice and snow from ventilation inlets and outlets.
4.1	Drainage	- a solution with hot water or steam, to remove ice and snow from drains from all work decks used for ORO activity.
3.2	Hydraulic oil quality	- hydraulic oil approved for use in -25°C or colder in all systems exposed to outdoor temperature.
3.2.	High pressure washer	- a solution for using high pressure washer with hot water as a de-icing system for deck area and ORO equipment. The equipment shall be available on all work decks and for all ORO equipment.
5.1	Laboratory	- a solution for de-icing the ventilation inlets and outlets.

3.2.	Connection point for cargo, hydraulics and air	- a solution to remove ice and snow from exposed connection points/couplings if they do not have a protected location.
3.2	Manifold drip tray	- a solution to prevent freezing/icing of drip tray and drainage.
5.1	Oil boom drum	- a solution to remove ice and snow with hot water or steam.
5.1	Oil skimmer crane	- a solution to remove ice and snow with hot water or steam.
5.1	Position of skimmers	- a solution to remove ice and snow from skimmer area with hot water or steam.
2.3	Oil skimmer platform (Where assigned)	- a solution to remove ice and snow from the oil skimmer platform.
3.2	Steam outlet	- a solution for using steam lance as a defrosting system for deck area and ORO equipment. Hoses should be long enough to reach all work decks and ORO equipment.
2.3	Towing boom system	- a solution for removing or protecting against snow and ice from covers to exposed winches used for the towing boom system.

# CHAPTER 5

## OR VESSEL WITH NOFO's OIL RECOVERY EQUIPMENT PERMANENTLY INSTALLED ON BOARD

### SECTION 1 GENERAL

#### 1 General requirements

##### 1.1 Purpose

1.1.1 This chapter specifies additional requirements to NOFO Standard 2021 for OR vessels with NOFO's oil recovery equipment permanently installed on board – also referred to as Standby vessels. An example of such an additional requirement is a hangar for oil recovery equipment. NB! Chapter 5 does not apply to mobilizable vessels.

1.1.2 Requirements included in Chapters 5 are additional requirements to Chapters 2 and 3.

1.1.3 However, the requirements in Chapter 5 fully replaces the requirements in Chapter 2, Section 2, "1 Deck arrangement" and "2 Anchoring points". All functional requirements in Chapter 2, Section 2, "3 Arrangement for towing of boom systems" shall be followed, but the location shall be adapted to the hangar for oil recovery equipment after dialogue with NOFO.

1.1.4 All system requirements in Chapter 3 shall be complied with, but the location of connections and outlets shall be adapted to the hangar for oil recovery equipment after dialogue with NOFO.

1.1.5 Oil recovery equipment placed on board shall be operated and maintained by the vessel's crew after completed training. Maintenance routines for the equipment shall be included vessel's planned maintenance system.

1.1.6 The purpose of the requirements in this chapter is to protect oil recovery equipment stored for extended periods of time, and to avoid deterioration of or damage to equipment as a result of exposure to weather.

1.1.7 The requirements are adapted to NOFO's conventional oil recovery equipment, Transrec 150 oil skimmer crane with associated overflow and heavy oil skimmers, as well as oil booms of the type Norlense 1200R or equivalent. The requirements in the chapter are not adapted to single boat systems. If the vessel is to be adapted to such equipment, NOFO shall be contacted for specific requirements for the individual equipment. In such cases, design, layout and ship-specific solutions shall take place in close dialogue and collaboration with NOFO.

#### 2 Hull and outfitting requirements

##### 2.1 Requirements

The equipment shall be operational at all times when onboard.

##### 2.2 Storage of spare parts

2.2.1 A dedicated room of at least 8 m<sup>2</sup> shall be available in the dirty zone. The room shall be dry and heated and should have a floor with drainage and anti-slip surface.

2.2.2 The room shall contain open areas, cabinets and shelves in accordance with the following specifications:

- Minimum 5 m<sup>2</sup> with open floor area for storage of equipment in boxes, crates, etc.
- Two steel cabinets with shelves/furnishings (w 1000 mm, d 550 mm, h 1900 mm)
- Shelves (w 950 mm, d 400 mm, h 1900 mm)
- Workbench w/drawers for tools

## **2.3 Laboratory**

2.3.1 A dedicated room of at least 10 m<sup>2</sup> outside the Ex-zone shall be available to NOFO as a laboratory and room for various electronic equipment. The room shall be dry and heated and have a floor with drainage and anti-slip surface.

2.3.2 The room shall be equipped with:

- Good ventilation – mechanical or natural.
- Local extraction ventilation at appropriate place by work bench. It should be possible to fix the extractor in place.
- Stainless steel sink with hot and cold water for cleaning contaminated laboratory equipment and emptying oil samples.
- Steel bench, shelves and cupboards for storage of equipment.
- Bench/shelf with six 230V 60Hz power outlets for connection and charging of electrical equipment.

## **2.4 Wardrobe between clean and dirty zone**

2.4.1 A suitable changing room shall be available as a barrier between the dirty and clean zone. The room will be used by the oil spill response personnel for cleaning and rinsing workwear as well as changing into personal clothing. (See Appendix B)

2.4.2 The room shall have the following equipment as counted from dirty towards clean zone:

- Cleaning room in a suitable cubicle with handheld shower with hot and cold water for cleaning and rinsing outerwear for two persons.
- Wardrobe with satisfactory waste capacity for used outerwear and dirty disposable clothing, as well as a bench in the separation between dirty and clean zone.
- Clean section for clothing and cabinets for storing personal clothing.
- Ventilation system with overpressure in clean zone and fan approved for relevant Ex zone.

## **2.5 Oil recovery equipment hangar**

2.5.1 Oil boom drum

2.5.1.1 The oil boom drum shall be installed on 20' ISO anchoring points in a sheltered area on the main deck aft or on the vessel's starboard side aft.

2.5.1.2 A hatch on starboard side or aft with an opening of minimum 6000 mm width and 2000 mm height for launching and recovery of oil boom shall be assigned. The lower part of the opening should be 1500 mm above deck level.

2.5.1.3 Minimum distances from the oil boom drum to the vessel side shall be 2000 mm and there shall be free access of 1000 mm on all sides. The shipside and other structure of this opening should be well rounded with a radius of minimum 250 mm.

2.5.1.4 There shall be no sharp edges in the vicinity that could damage the oil boom during launching or recovery.

2.5.1.5 The hatch shall be hydraulically operated and able to be locked hydraulically in open and closed position for quick operation.

2.5.1.6 A top hatch shall be located above the oil boom drum to facilitate change of equipment. The top hatch shall be centered above the fastenings and be at least 7500 mm long and 3000 mm wide.

2.5.1.7 The length of all hoses shall be adjusted individually with regard to the connection points.

2.5.2 Oil skimmer crane

2.5.2.1 The oil skimmer crane shall be installed on 20' ISO anchoring points on the starboard side aft near the oil boom drum.

2.5.2.2 The oil skimmer crane shall be placed behind the oil boom drum if it is located on the starboard side. Operating radius and pinch zones shall be considered.

2.5.2.3 A side hatch for launching and recovery of the overflow skimmer or heavy oil skimmer shall be assigned on the starboard side. The hatch opening shall be minimum 7670 mm wide and 6500 mm high. The lower part of the hatch can be flush with deck, if temporary measures against falling overboard is arranged when open.

2.5.2.4 The hatch shall be hydraulically operated and shall be able to be locked hydraulically in open and closed position for quick operation.

2.5.2.5 Height below deck shall be a minimum of 5800 mm.

2.5.2.6 The side hatch and top hatch can be combined in a gull wing design. The gull wing should be designed so that the top part of the hatch can be closed down with the oil skimmer deployed, to create as much shelter as possible in the hangar.

2.5.2.7 The oil skimmers shall be able to be deployed perpendicular to the shipside (90 degrees) and aft to 55 degrees aft across.

2.5.2.8 A top hatch should be located above the oil skimmer crane in order to easily change the oil skimmer crane with associated skimmers. The top hatch shall be centered above the attachment and be at least 7500 mm long and 3000 mm wide. The top hatch shall be designed to enable lifting out of skimmers from the parked position.

2.5.2.9 If the side hatch and top hatch are combined in a gull wing, the lower part shall be designed to be folded in the open position in a way that does not obstruct the deployment and retrieval of the oil recovery equipment.

2.5.2.10 The length of all hoses shall be adjusted individually with regard to the connection points.

### 2.5.3 Positioning of skimmers

2.5.3.1 Overflow skimmer and heavy oil skimmer shall be placed in the same area as the oil skimmer lifting device.

2.5.3.2 Both skimmers shall be placed to facilitate easy change from one to the other, and for easy launching and recovery.

2.5.3.3 The skimmers shall be stored in a horizontal position with sufficient space for service and maintenance when they are stored/parked.

2.5.3.4 Umbilical/cargo hose stiffness needs to be taken into account for connection between oil skimmer crane and skimmer. Dedicated parking frames can to some extent compensate for a short distance.

### 2.5.4 Anti-slip on deck for personnel safety:

Gratings should be installed in areas containing oil recovery equipment. The gratings should be installed with possibility for dismantling.

### 2.5.5 Drainage of hangars for oil recovery equipment:

Suitable arrangement should be provided for direct drainage of oil spills from hangar into a tank for recovered oil.

### 2.5.6 Monitoring of activities in hangars for oil recovery equipment:

A camera shall be installed near the oil boom drum and oil skimmer crane in order to monitor the area from the bridge. It should be possible to monitor personnel's safety, as well as efficient and safe launching and recovery of oil recovery equipment.

### 2.5.7 Arrangement for towing of boom system:

Ref. requirements as described in Chapter 2.

### 2.5.8 Winch for transverse towropes:

Winch for transverse towrope operation with specifications as described in the standard should be available.

### 2.5.9 Electrical power outlets:

- 1 outlet 1 - phase 230V/16A near the oil skimmer crane  
CEAG outlet 1 - Phase - 16A/230V Eex-de **(Blue)** - GHG 5114306 R 0001

- 1 outlet 1 - phase 230V/16A near oil boom drum  
CEAG outlet 1 - Phase -16A/230V Eex-de **(Blue)** - GHG 5114306 R 0001
- 1 outlet 1 - phase 230V/16A in hangar  
CEAG outlet 1 - Phase - 16A/230V Eex-de **(Blue)** - GHG 5114306 R 0001
- 1 outlet 3 - phase 440V/32 A in hangar  
CEAG outlet 3 - Phase - 32 A - 32A/380/440 Eex-de **(Red)** - GHG 5124406 R0001

#### 2.5.10 Hydraulic outlets:

All the vessel's couplings shall be close to NOFO equipment. Hydraulic outlets can be distributed in two different locations with pressure, leakage, return in the vicinity of the oil skimmer crane and oil boom drum. This is to keep the length of hoses as short as possible. Hydraulic hoses connecting the vessel and NOFO equipment shall be available on board.

#### 2.5.11 Outlets for high pressure washers:

Two outlets for high pressure washers should be available in the hangar/dirty zone.

#### 2.5.12 Outlets for air:

Air outlets shall be placed near the oil boom drum.

#### 2.5.13 Outlet for steam:

Steam outlets shall be placed to facilitate cleaning of the entire hangar with the hose/lance arrangement.

#### 2.5.14 Connection to the oil recovery system

The connection point shall be arranged to provide an appropriate connection to the oil skimmer crane. Short hoses/pipes can be assigned for connection.

## 3 System requirements

### 3.1 Requirement

All systems shall be operational at all times.

# CHAPTER 6 OR VESSELS WITH PERMANENTLY INSTALLED EQUIPMENT FOR DISPERSION

## SECTION 1 GENERAL

### 1 General requirements

#### 1.1 Purpose

1.1.1 This chapter specifies additional requirements to NOFO Standard 2021 for OR vessels with permanently installed equipment for dispersion on board.

1.1.2 The dispersion system including pipes, storage tanks and aeration from tanks should be designed to preserve the quality of the dispersant while it is stored on board.

1.1.3 The equipment shall be operated and maintained by the vessel's crew.

1.1.4 The requirements shall ensure that vessels equipped with permanent dispersion equipment on board are operational at all times.

1.1.5 Routines for sampling and quality control of the dispersant shall be established and followed.

#### 1.2 Dosage

1.2.1 The equipment should have dosing rates to satisfactorily combat thin and thick oil films, where it is operationally possible to separate these.

- Typical quantity of application for thin oil films (0.2 mm thick): 2-5 tons/km<sup>2</sup>, with acceptable droplet size 0.5 - 1 mm (diameter).
- Typical quantity of application for thick oil films (2 mm thick): 25-30 tons/km<sup>2</sup>, with acceptable droplet size 1 - 2 mm (diameter).

1.2.2 This can be solved by using two separate nozzle arrangements that can be used individually and simultaneously. A dosage table shall be made with an overview of applied quantity in various speed ranges.

#### 1.3 Dispersant

Suitable and approved dispersants compatible with NOFO equipment should be used. An example of such a dispersant is Dasic NS Slickgone.

## 2 Hull and equipment requirements

### 2.1 Requirements

2.1.1 The equipment shall be arranged for operation from the bridge in addition to local operation. A camera shall be installed for monitoring and safe handling of the equipment.

2.1.2 Dispersion equipment shall as far as possible be stored and operated from a protected area.

### 2.2 System for applying dispersant

Location of the dispersant application system shall be approved by NOFO and be installed on the vessel according to the following specifications:

- The dispersant shall be applied on parts of the surface which has not yet been affected by waves generated by the vessel.

- Effective continuous application width should be a minimum of 28 meter.
- Application of dispersant shall be continuous and evenly distributed on the surface over the entire application width.
- The height of the application system should be adjustable during the application operation. The height should be between two and six meters above sea surface.
- The system shall be operable under icing conditions and temperatures below zero degrees °C.

### **2.3 Tank filling and emptying**

2.3.1 A connection for filling and discharging dispersant tanks (3" TW tank truck, male) shall be available midships at both sides of the vessel.

2.3.2 The coupling should be of a non-corrosive type. The system shall be built in such a way that pumps, tanks and pipes are solely used for dispersants.

### **2.4 Application method**

2.4.1 It is a requirement that the dispersant is applied on the oil spill with high efficiency.

2.4.2 Droplet size is important in this regard - small droplets may be displaced by wind while too large droplets may penetrate the spill and be dissolved in the water below.

2.4.3 Dispersants may affect respiration and are irritating to eyes on contact, in addition to creating slippery surfaces when spilled. Therefore, it is important to avoid spills and clouds of aerosol on deck and other areas where personnel may be present.

2.4.4 When combating thinner oil films with traditional equipment, the optimum droplet size be in the range 400 to 1000 µm. For thicker oil films, a droplet size up to 2000 µm may work satisfactorily.

### **2.5 Mobilization requirements**

The total mobilization time of the dispersant system shall not exceed 30 minutes. The vessel's crew shall be able to carry out the work.

### **2.6 Capacity**

2.6.1 The minimum tank capacity for dispersant shall be 100 m<sup>3</sup> distributed on minimum four tanks. The tanks shall be designed to minimize sloshing and free liquid surface and be located in an area with stable temperatures.

2.6.2 All installed pipes, pipe components and hoses in the system shall be of suitable material and satisfy a pressure rating of 10 bar.

### **2.7 Requirements to material in pipes and storage tanks**

The dispersant is a corrosive liquid. Pipes and storage tanks shall be made of stainless steel (SS316) or painted with appropriate chemical-resistant paint.

### **2.8 Arrangement for drainage and sampling**

2.8.1 Arrangements enabling easy dispersion-liquid sampling for analysis from top, middle and bottom of tanks shall be available, as well as arrangements for drainage of possible contaminated dispersant (minimum pipe dimension 1").

2.8.2 It shall be possible to mix the tank contents by circulating the liquid with a suitable pump.

2.8.3 It shall be possible to discharge the tank content with a pump having a capacity of minimum 20 m<sup>3</sup>/hour for the purpose of replacing dispersant or emptying for inspection purposes.

## **2.9 Level gauges**

Dispersant tanks shall be fitted with level gauging.

## **2.10 Pump capacity and operation**

2.10.1 The dispersant pump shall be able to correctly apply the dispersant with constant pressure and flow rate at variable viscosity.

2.10.2 There shall be a back-up pump with the equal capacity as the main pump available.

## **2.11 Remote control of the operation**

It shall be possible to operate pumps and valves remotely from the bridge.

## **2.12 Air pipes dispersant tanks**

Venting associated with tanks for storing dispersant shall be designed to ensure that no water and moist air can enter the tanks.

## **2.13 Blind flange valves**

The dispersion system shall have blind flange valves in the pipe system to and from the tanks to ensure that the dispersant on board is properly stored and secured against ingress of water during testing.

# **3 System requirements**

## **3.1 Requirements**

These are requirements that apply in cases where vessels shall have both NOFO standard dispersion equipment and own dispersion equipment.

## **3.2 Materials**

All installed pipes, pipe components and hoses in the system shall be of suitable material and satisfy a pressure rating of 10 bar.

## **3.3 Flow meter and pressure gauges**

Pressure gauging shall be installed in a suitable location, close to point of application and be connected to the vessel's IAS.

An additional pressure gauge shall be installed by the loading/discharge pump. It shall be possible to measure the flow volume.

## **3.4 Filter**

A strainer box with coarse filter, arranged with a "by-pass"-line, shall be installed between tank and pump.

A duplex fine filter, also arranged with a "by-pass"-line, shall be installed after the coarse filter. Each filter shall as a minimum have a filtering capacity of 300 % of maximum flow. The supplier of nozzles will specify necessary degree of fineness. Sufficient access for cleaning of filters during operation shall be ensured.

## **3.5 Start/stop of the dispersion system**

The system shall be such that efficient application occurs immediately after start and ceases immediately after stop.

### **3.6 Flushing and testing**

3.6.1 A separate freshwater tank shall be connected to the system for flushing, testing and exercises. Minimum tank capacity is 1.0 m<sup>3</sup>.

3.6.2 It shall be possible to purge the system using air.

## **CHAPTER 7**

# **APPROVAL PROCESS OF OR VESSELS ON THE NORWEGIAN CONTINENTAL SHELF**

### **SECTION 1 GENERAL**

#### **1 Approval process for newbuilding**

##### **1.1 Process for obtaining NOFO certificate for newbuilding**

1.1.1 NOFO shall be informed when a ship is to be built in accordance with NOFO Standard 2021.

1.1.2 During the design phase, the designer/shipbuilder shall send drawings in paper and electronic format (AutoCad/.dwg) to NOFO for review. (See overview in Table Table 2)

1.1.3 NOFO will provide comments and advice to shipowner/shipbuilder.

1.1.4 Upon completion of a newbuilding, NOFO shall be contacted for inspection of the vessel. After the inspection, a report is issued indicating any deficiencies.

1.1.5 After delivery, the vessel shall carry out a technical check-out and an exercise with NOFO equipment on board at one of NOFO's bases. If the vessel is not accepted, NOFO will issue a report indicating the deficiencies.

1.1.6 NOFO certificate is issued by NOFO after satisfactory completion of exercise and any deficiencies confirmed closed.

1.1.7 For an overview of the process, see flow chart on the next page.

##### **1.2 Certificate**

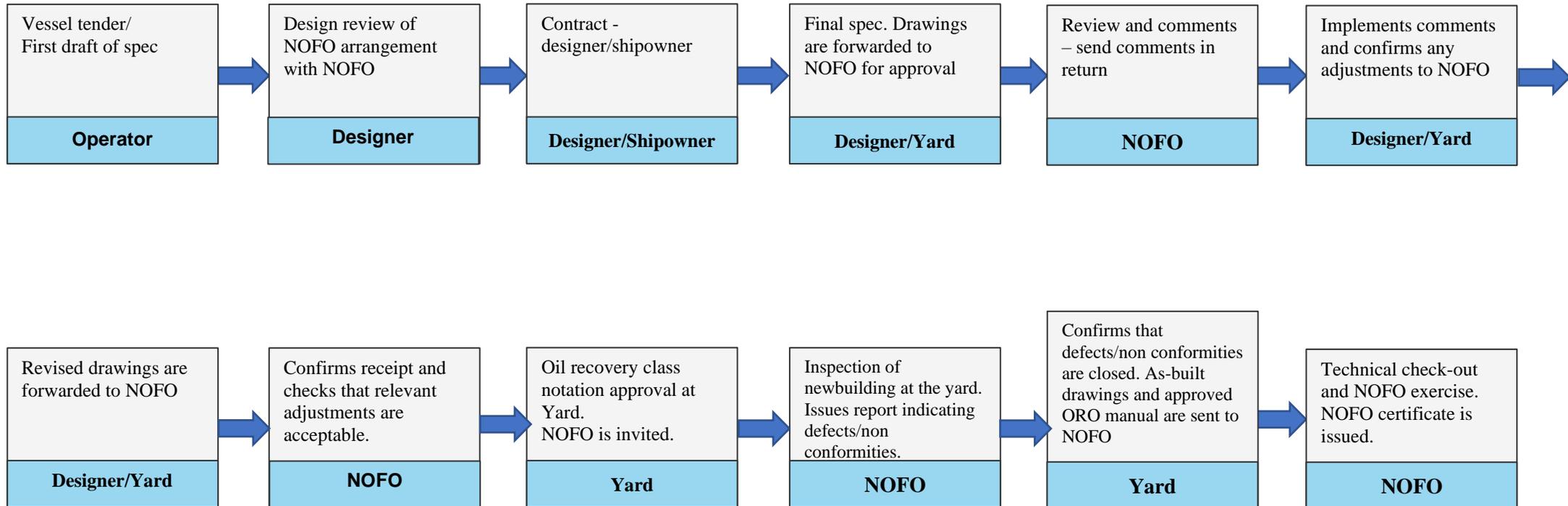
1.2.1 The NOFO certificate is valid for 3 years from the time of issue, or 3 years from the last NOFO exercise, and shall be onboard the vessel.

1.2.2 Vessels that have been out of NOFO's emergency fleet or have not participated in NOFO exercises for the last 3 years shall undergo technical re-check-out and exercise before a new certificate is issued.

##### **1.3 Checklist**

See Appendix A.

1.4 Overview of certificate attainment process - new building



## **2 Approval process for existing vessels**

### **2.1 Process for obtaining NOFO certificate for existing vessels**

2.1.1 The shipowner shall inform NOFO when a vessel is requested to be in accordance with NOFO standard 2021.

2.1.2 The shipowner shall send as-built drawings in paper and electronic format (AutoCad/.dwg), as well as the ORO manual to NOFO for review. (See overview in Table Table 2)

2.1.3 NOFO reviews the documentation and provides comments on any deficiencies to the shipowner.

2.1.4 After documentation has been reviewed, and any modifications/adaptations have been carried out, the vessel shall carry out a technical check-out and an exercise with NOFO equipment on board at one of NOFO's bases.

2.1.5 NOFO certificate is issued by NOFO after satisfactory completion of exercise and any deficiencies confirmed closed.

2.1.6 For an overview of the process, see flow chart on the next page.

### **2.2 Certificate**

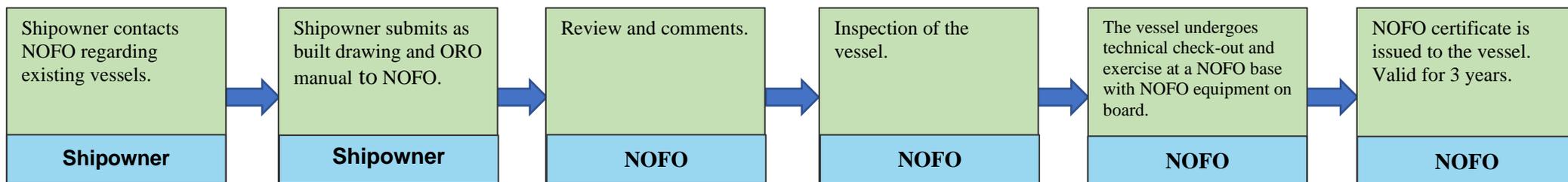
2.2.1 The NOFO certificate is valid for 3 years from the time of issue, or 3 years from the last NOFO exercise, and shall be onboard the vessel.

2.2.2 Vessels that have been out of NOFO's emergency fleet or have not participated in NOFO exercises for the last 3 years shall undergo technical re-check-out and exercise before a new certificate is issued.

### **2.3 Checklist**

See Appendix A.

## 2.4 Overview of the process for obtaining a certificate for existing vessels



## APPENDIX A - CHECKLIST

<b>Category column</b> description is as given below:	
<b>D</b>	Document review
<b>S</b>	Onboard verification
<b>D + S</b>	Document review and onboard verification
<b>C</b>	Certificate review

Ref.	Content	Action	Category	Comments
<b>Chapter 1 INTRODUCTION AND GENERAL REQUIREMENTS</b>				
<b>Section 1 Requirements</b>				
<b>Part 1 Introduction</b>				
1.1	Does the vessel satisfy all requirements imposed by the Norwegian authorities and by classification societies for ocean-going OR vessels?		<b>D + C</b>	
1.2	Is the DP system on board minimum IMO Class 1?	Yes/No - Verified on board	<b>D</b>	
1.3	Are there any discrepancies before the inspection?	Documented?	<b>D</b>	
<b>Chapter 2 HULL AND OUTFITTING REQUIREMENTS</b>				
<b>Section 1 Tanks in Oil Recovery Operations</b>				
<b>Part 1 ORO tank capacity</b>				
1.1	Check capacity plan and record tank capacity – minimum 1800 m <sup>3</sup>	Documented	<b>D</b>	
1.4	Manholes and hatches including inspection hatches should be minimum 600 x 800mm and availability from deck.	Verify on board	<b>S</b>	
<b>Part 2 ORO tank heating requirements</b>				
2.1	Is the heating arrangement able to enable a temperature increase of 15°C within 12 hours?	Documented and one tank to be tested.	<b>D + S</b>	

Ref.	Content	Action	Category	Comments
<b>2.1</b>	It shall be possible to utilize the entire heat source capacity at the same time on any combination of a maximum of three tanks.	Documented	<b>D</b>	
<b>Section 2 ORO deck outfitting</b>				
<b>Part 1 Deck arrangement</b>				
<b>1.2</b>	Fastening clearance in accordance with Table 5 for vessel installations and oil recovery equipment.	Verify on board	<b>S</b>	
<b>1.3</b>	Minimum opening stern gate: 7.0 m x 2.5 m (width x height).	Verify on board	<b>S</b>	
<b>1.3</b>	The opening shall be free from all sharp edges, reinforcements, bolts, hydraulic cylinders, limit switches and any other elements that may damage or catch the oil boom.	Verify on board	<b>S</b>	
<b>1.4</b>	Height of aft cargo rail starboard can be a maximum of 2.5 m, if exceeded a platform shall be assigned.	Verify on board	<b>S</b>	
<b>1.4</b>	The platform shall withstand a static load of 20 tons.	Documented	<b>D</b>	
<b>1.4</b>	The platform shall be at least 8.0 m long and 5.4 m wide with railing according to regulatory requirements.	Verify on board	<b>S</b>	
<b>Part 2 Anchoring points</b>				
<b>2.1</b>	The vessel shall have permanent anchoring points for all NOFO equipment installed on deck.	Verify on board	<b>S</b>	
<b>2.1</b>	The anchoring points shall have a SWL of at least 25 tons.	Verify on board	<b>S</b>	
<b>2.2</b>	The anchoring points for oil skimmer crane shall be dimensioned for a weight of 20 tons.	Verify on board Class approval for deck strength / SWL 20 tons	<b>D + S</b>	
<b>2.3</b>	The anchoring points for oil boom drums shall be dimensioned for a weight of 30 tons.	Verify on board. Class approval for deck strength / SWL 30 tons	<b>D + S</b>	

Ref.	Content	Action	Category	Comments
<b>Part 3 Arrangement for towing of boom systems</b>				
3.1	A bollard, a capstan and a fairlead shall have SWL 25 tons.	Verify on board	<b>D + S</b>	
3.1	The fairlead shall be approx. 10-15 m from the transom.	Verify on board	<b>S</b>	
3.2	Winch and fairlead shall be assigned on the main deck in cargo rail on starboard side approx. 30 meters from the transom.	Verify on board	<b>S</b>	
3.2	Transverse towropes: <ul style="list-style-type: none"> <li>• Minimum SWL of winch: 10 tons</li> <li>• Rope: fiber material, SWL 10 tons, safety factor 3, maximum weight 25kg/100m</li> </ul>	Verify on board	<b>D + S</b>	
3.2	The winch shall have camera surveillance from the bridge and be able to be operated remotely from the bridge in addition to location control.	Verify on board	<b>S</b>	
3.3	Towropes on bow winch SWL 10 tons	Verify on board	<b>D + S</b>	
3.3	The winch shall have camera surveillance from the bridge and be able to be operated remotely from the bridge in addition to location control.	Verify on board	<b>S</b>	
<b>Section 3 Miscellaneous</b>				
<b>Part 1 Cabin capacity</b>				
1.1	The vessel shall have a minimum of 10 berths for NOFO's oil spill response personnel.	Verify on board	<b>S</b>	
1.1	Maximum of two berths in each cabin.	Verify on board	<b>S</b>	
<b>Part 2 Wheelhouse</b>				
2.2	The vessel shall have fixed UHF on bridge and in the engine control room.	Verify on board	<b>S</b>	

Ref.	Content	Action	Category	Comments
2.2	The vessel shall have portable Ex proof UHF communication equipment for the deck crew	Verify on board	<b>S</b>	
<b>Part 3 Speed log</b>				
3	The vessel shall be equipped with a log for measuring relative speed between water and vessel.	Verify on board	<b>S</b>	
<b>Chapter 3 SYSTEM REQUIREMENTS</b>				
<b>Section 1 General requirements</b>				
<b>Section 2 Specific requirements</b>				
<b>Part 1 Discharge and loading system</b>				
<b>1.1 Discharge and loading</b>				
1.1	Pumps and piping systems – specify the type of pumps, valves and piping systems.	Documentation	<b>D</b>	
1.1	The piping system shall enable circulation of the volume in individual tanks without having to interrupt loading/discharging of other tanks.	Documentation	<b>D</b>	
1.1	Blind flange valve housings shall be easily accessible, clearly marked with signal yellow color, and marked whether they should be open or closed in ORO.	Verify on board	<b>S</b>	
1.1	Blind flange valves shall be stored in the immediate vicinity of the valve housing.	Verify on board	<b>S</b>	
<b>1.2 Discharge capacity</b>				
1.2	The discharge capacity shall be a minimum of 500 m <sup>3</sup> /hour vs. 3 bar at 3,000 cSt viscosity	Documentation	<b>D</b>	
1.2	The discharge capacity shall be a minimum of 300 m <sup>3</sup> /hour vs. 7 bar at 3,000 cSt viscosity	Documentation	<b>D</b>	

Ref.	Content	Action	Category	Comments
1.2	The discharge capacity should be achieved by simultaneous discharging of no more than half of the tanks.	Documentation	D	
<b>1.3 Pumps</b>				
1.3	Pumps and piping systems – specify the type of pumps, valves and piping systems.	Check drawings/specifications	D	
1.3	Choice of pumps (screw pumps, etc.) – Verify suitability for oil/emulsions.	Documentation	D	
1.3	Capacity per pump – Min. 100 m <sup>3</sup> /hour. All capacity figures shall be documented at 3,000 cSt.	Pump specifications/calculations	D	
<b>1.4 Valves</b>				
1.4	Valves in ORO system - Switching between tanks during loading/discharging should be possible using remotely operated valves.	Verify on board	S	
<b>1.5 Manifold</b>				
1.5	Manifold placement – Approx. 15 m from the vessel's transom on the starboard side within the dirty zone.	Check event drawing and verify on board	D + S	
1.5	Ensure that there is space for connection of the loading hose and that the hose has a natural run, without sharp bends, down towards the main deck.	Verify on board	S	
1.5	The arrangement of manifold and piping system shall allow loading and discharging at the same time.	Verify on board	S	
1.5	Loading and discharging connection – type 6" Weco union, female connection, wp 1000/69 psi/bar.	Drawings/certification and onboard verifications	D + S	
1.5	A drip tray shall be mounted below the manifold.	Verify on board	S	
<b>1.6 Filters</b>				

Ref.	Content	Action	Category	Comments
1.6	Fixed, double filter arrangements shall be equipped on the vessel's cargo line.	Verify on board	S	
1.6	The filter box shall be equipped with quick-lock.	Verify on board	S	
1.6	Filter capacity and availability - 700 m <sup>3</sup> /hour at 3,000 cSt.	Specification/drawings	D	
1.6	Pressure drop over the filter arrangement shall be less than 0.5 bar. Manometers shall be mounted on both sides of the filter to monitor pressure drop.	Verify on board	S	
<b>Part 2 Electric power supply</b>				
2.1	Four outlets starboard side: CEAG outlet 1 - phase - 16A/230V Eex-de - GHG 5114306 R 0001	Verify on board	D + S	
2.1	Two outlets starboard side: CEAG outlet 3 - Phase - 100 kW- 32A/380/440 Eex-de - GHG 5124406 R0001	Verify on board	D + S	
2.1	Four outlets port side: CEAG outlet 1 - phase - 16A/230V Eex-de - GHG 5114306 R 0001	Verify on board	D + S	
2.1	Two outlets port side: CEAG outlet 3 - Phase - 100 kW- 32A/380/440 Eex-de - GHG 5124406 R0001	Verify on board	D + S	
2.1	Outlets shall be placed in tight stainless steel cabinets marked "NOFO".	Verify on board	S	

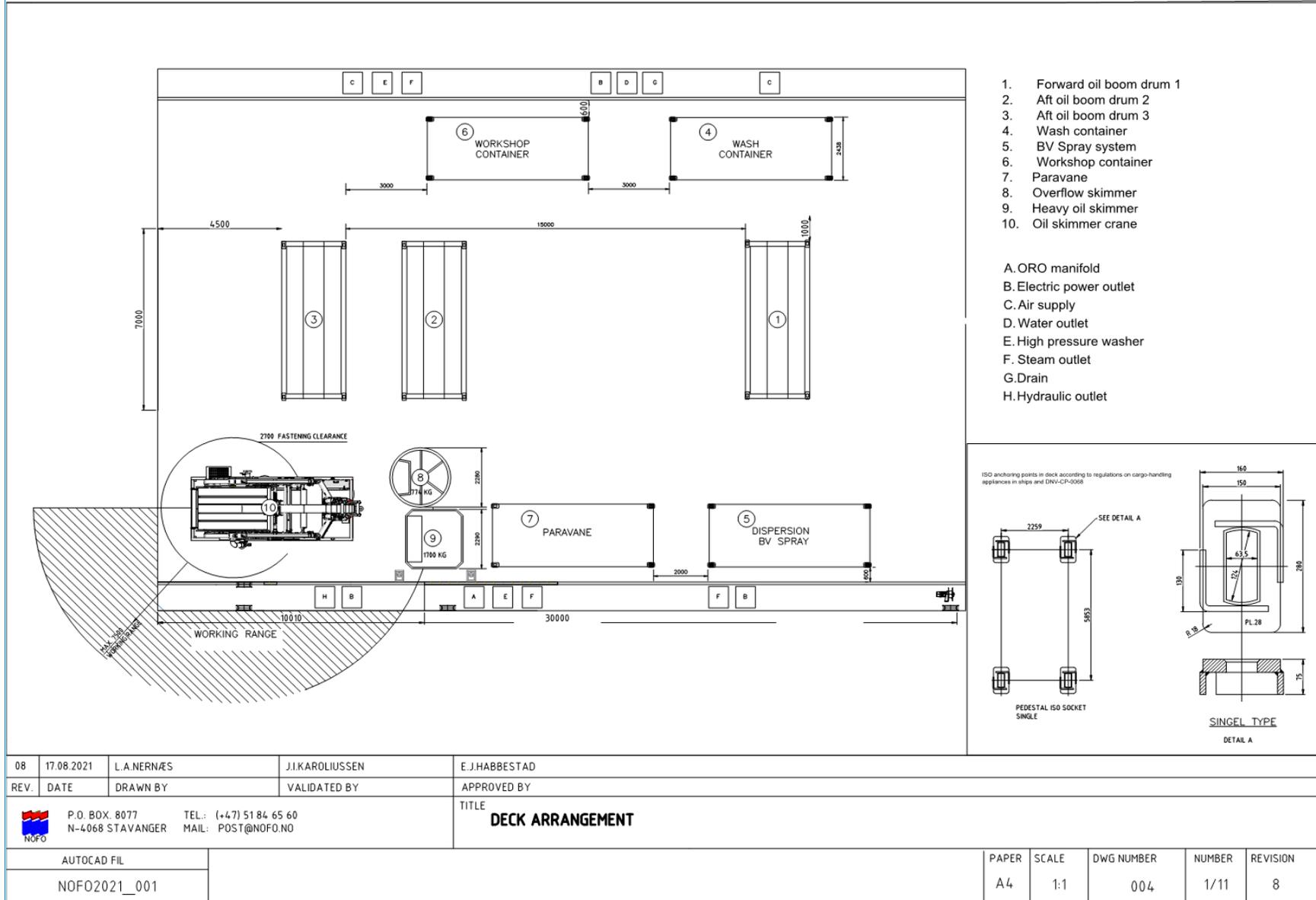
Ref.	Content	Action	Category	Comments
<b>Part 3 Air supply system</b>				
<b>3.1 Air supply to power tools</b>				
3.1	Compressed air outlets for operation of tools/equipment shall be located within the cargo rails in the dirty zone, on both sides of the vessel.	Verify on board	<b>S</b>	
<b>3.2 Air supply to oil boom</b>				
3.2	The compressed air system on deck shall have a capacity of at least 5 m <sup>3</sup> /min at 6 bar.	Verify on board	<b>D + S</b>	
3.2	The following coupling should be available: <ul style="list-style-type: none"> <li>• 1 x Quick snap Type Hansen connection (female) 1/2"</li> <li>• 2 x Camlock connection (female) 1½"</li> <li>• 1 x Claw coupling 1", European standard with the possibility of safety pin</li> </ul>	Verify on board	<b>S</b>	
3.2	Reserve capacity – two independent sources of compressed air	Verify on board	<b>S</b>	
<b>Part 4 Steam, water and wastewater systems</b>				
<b>4.1 Water outlets</b>				
4.1	Water outlets shall be placed within the port side cargo rail in the dirty zone at the anchoring point for wash container with:	Verify on board	<b>S</b>	
4.1	Claw coupling 1", European standard with the possibility of safety pin	Verify on board	<b>S</b>	
<b>4.2 High pressure washer with lance</b>				
4.2	Outlets for high pressure washers shall be placed within the cargo rail in the dirty zone, on the starboard and port side at the aft oil boom winch and anchoring point of the oil skimmer crane.	Verify on board	<b>D + S</b>	
4.2	ERGO connection (female), 3/8"	Verify on board	<b>S</b>	
4.2	Capacity - 160 bar, 1200 liters per hour	Specification	<b>D</b>	
4.2	Minimum temperature - 80 degrees °C	Specification	<b>D</b>	

Ref.	Content	Action	Category	Comments
4.2	Lance with 25 m hose	Specification	<b>D</b>	
<b>4.3 Steam outlet with lance</b>				
4.3	Steam outlets shall be placed within the cargo rail in the dirty zone, on the starboard and port side at the aft oil boom winch and anchoring point of the oil skimmer crane.	Verify location	<b>S</b>	
4.3	ERGO connection (female), 3/8"	Verify on board	<b>S</b>	
4.3	1" Steam Valve Outlet - Certified	Check certificate	<b>C</b>	
4.3	Pressure: 5 bar	Specification	<b>D</b>	
4.3	Temperature: 140 degrees °C	Specification	<b>D</b>	
4.3	Lance with 1" steam hose – minimum 25m	Check certificate	<b>C</b>	
<b>4.4 Washing water drain from wash container</b>				
4.4	A connection shall be placed within the cargo rail in the dirty zone on the port side by the wash container anchoring point. Camlock connection (male) 1½"	Verify on board	<b>S</b>	
<b>Part 5 Hydraulic power systems</b>				
<b>5.1 Hydraulic outlets and couplings</b>				
5.1	Hydraulic outlets from the vessel's hydraulic system shall be placed within the starboard side cargo rail approx. 10 m from the transom.	Verify on board	<b>S</b>	
5.1	Pressure gauge/manometer to be installed at the outlet.	Verify on board	<b>S</b>	
5.1	Hydraulic couplings – type/dimension – acid-proof female couplings.	Check certificate/specification	<b>D + S</b>	
5.1	The high-pressure piping shall be fitted with a shut-off valve and be routed to two outlets with the following 1¼" connections: Snap Tite S71-3C16-20RP med sleeve lock	Specification and check on board	<b>D + S</b>	

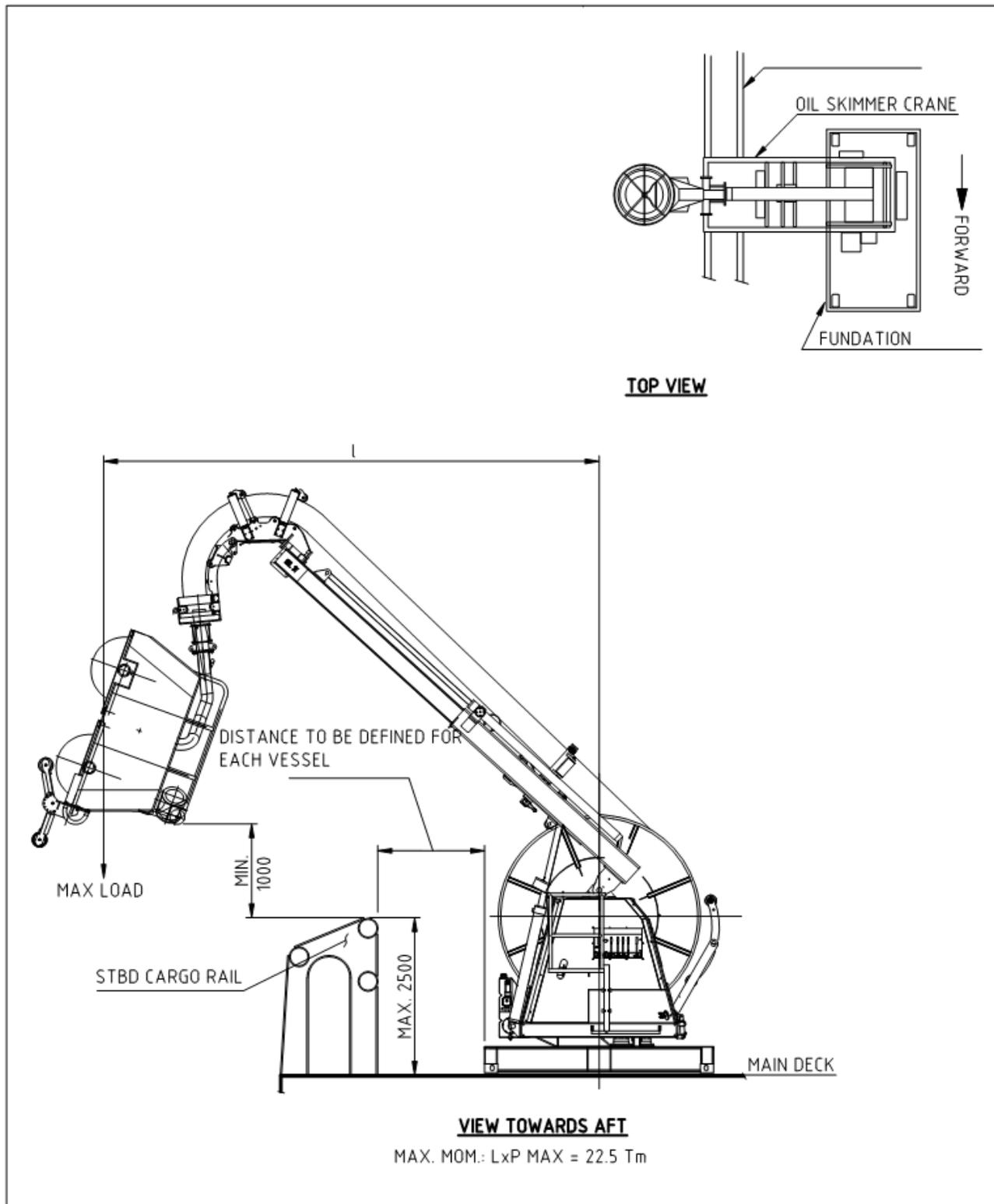
Ref.	Content	Action	Category	Comments
5.1	The return piping shall be routed to two outlets with the following 1½" connections: Tema - Flat face FF10010 - 150 RV	Specification and check on board	D + S	
5.1	The drainage piping shall be routed to two outlets with the following ½" connections": His 5101RV	Specification and check on board	D + S	
<b>5.2 Capacity and reserve capacity</b>				
5.2	Hydraulic capacity - 295 l/min at 280bar - Return: <5 bar, Leak: <1 bar	Verify on board	D + S	
5.2	Hydraulic capacity - 390 l/min at 240bar - Return: <5 bar, Leak: <1 bar	Verify on board	D + S	
5.2	The system shall have a minimum reserve capacity of 50%– If the total capacity is delivered by two pumps, there shall be a third pump that delivers 50% of the total capacity.	Specifications for pumps and verification of onboard	D + S	
5.2	The system shall have cooling arrangements for the hydraulic oil to prevent overheating during continuous operations.	Verify on board	D + S	
5.3	Hydraulic oil quality	Verify on board	D + S	
<b>Part 6 Bridge systems</b>				
6.1	The vessel shall have a permanently installed oil spill detection radar (OSD) for "real-time" oil detection.	Verify on board	S	
6.2	The vessel shall have a permanently installed infrared camera on starboard side on top of the wheelhouse for "real-time" oil detection without obstacles in the operational area.	Verify on board	S	
6.3	It shall be possible to present the ORO system in a separate module in the IAS system on bridge and in engine control room.	Verify on board	S	
6.4	The vessel shall have a dedicated workstation for OCS	Verify on board	S	

Ref.	Content	Action	Category	Comments
6.5	The vessel shall have a dedicated area for remote monitoring equipment on starboard side on top of the wheelhouse without obstacles in the operating area	Verify on board	S	
6.6	The vessel will have dedicated bracket for MBR (Minimum Broadband Radio) antennas located on each sides of the top of the wheelhouse.	Verify on board	S	
6.7	An open area on the bridge should be available to enable the placement of remote sensing consoles.	Verify on board	S	
6.8	Minimum bandwidth of 1024 Mbits shall be available under ORO.	Verify on board	S	
<b>Part 7 Safety systems</b>				
7.1	When open gates are required during ORO, temporary measures against falling overboard shall be arranged.	Verify on board	S	
7.2	The entire NOFO work area shall have sufficient working light (minimum 100 lux) with relevant Ex certification.	Verify on board	S	
7.3	The vessel shall be equipped with a MOB boat located in a davit on the port side.	Verify on board	S	
7.4	The vessel shall have a fixed system for detection of hydrocarbons in ORO mode. Number and location of measuring points according to class notation for Oil Recovery.	Verify on board	S	
<b>Chapter 4 OPERATION IN COLD CLIMATE</b>				
<b>Section 1 General</b>				
<b>Part 1 Additional requirements for operation in cold climates</b>				
	Measures to maintain the function of systems and equipment in Table 6 shall be assessed in accordance with the table.	Verify on board	D + S	

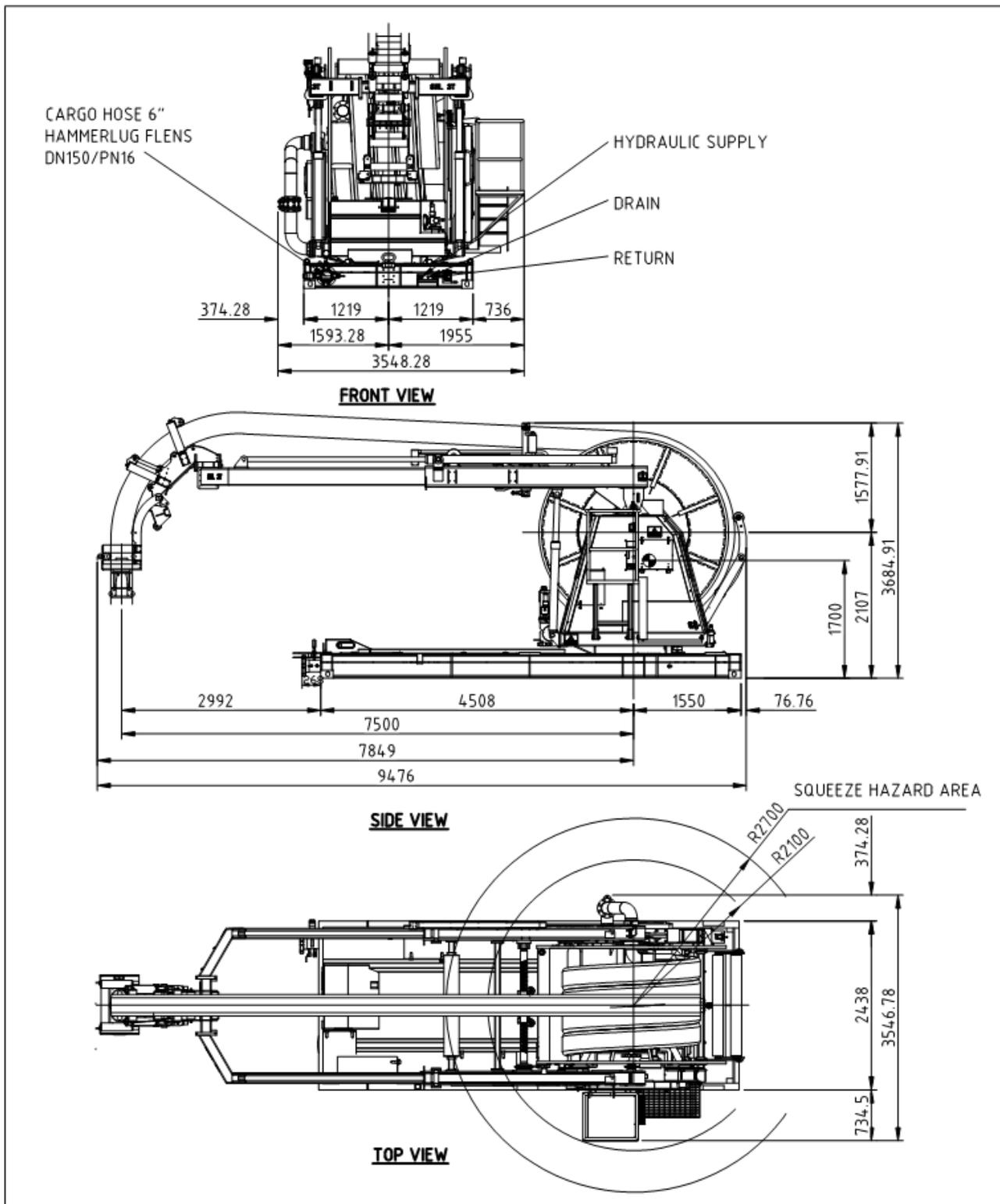
## APPENDIX B - DRAWINGS



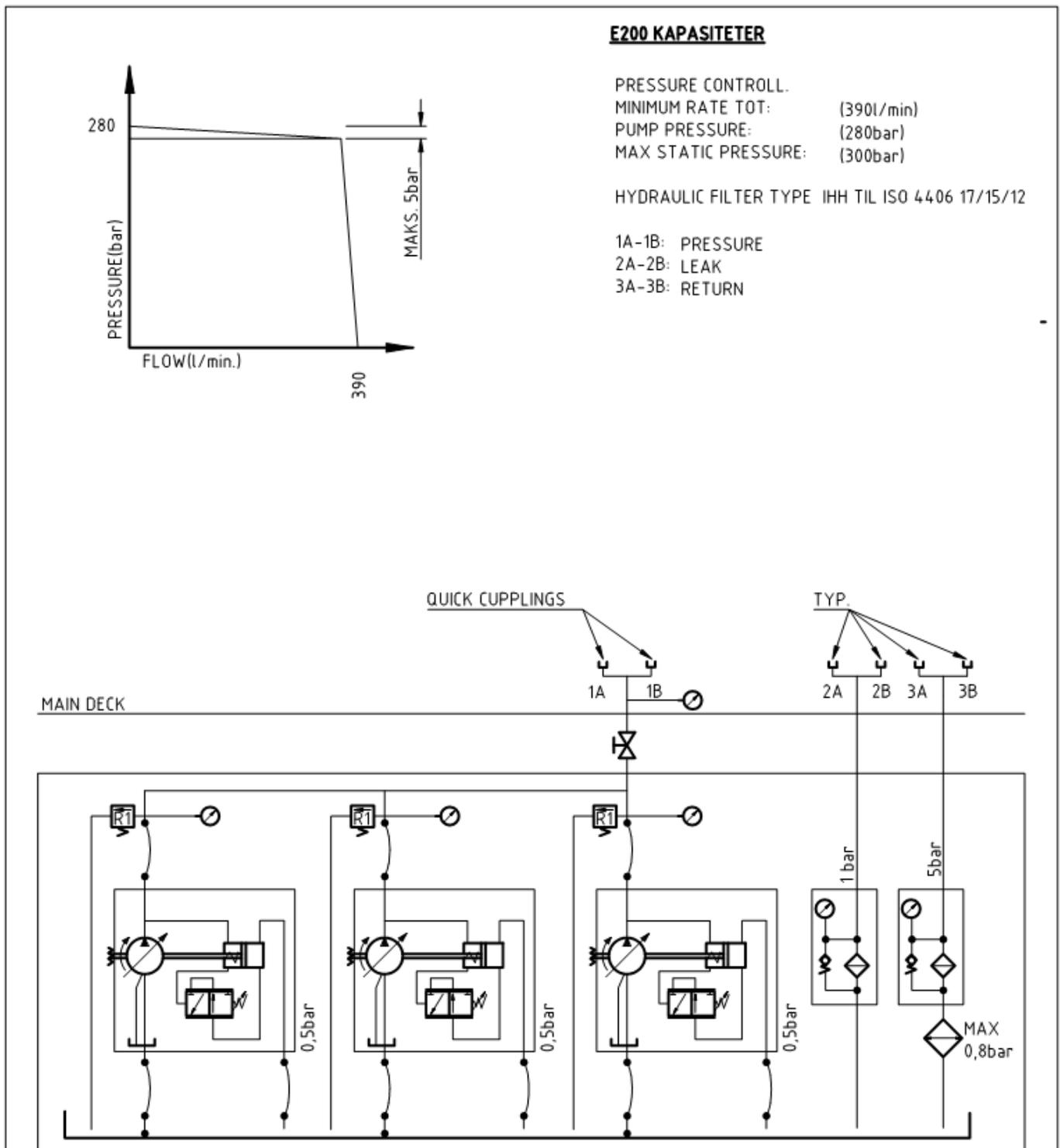




08	17.08.2021	L.A.NERNÆS	J.I.KAROLIUSSEN	E.HABBESTAD			
REV.	DATE	DRAWN BY	VALIDATED BY	APPROVED BY			
 P.O. BOX. 8077 N-4068 STAVANGER TEL.: (+47) 51 84 65 60 MAIL: POST@NOFO.NO			TITLE OIL SKIMMER CRANE - TRANSREC 150				
AUTOCAD FIL			PAPER	SCALE	DRW NUMBER	NUMBER	REVISION
NOFO2021_003			A4	1:1	03	3/11	8



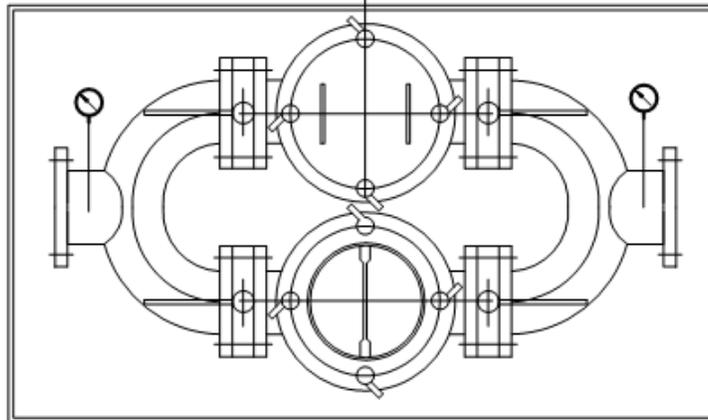
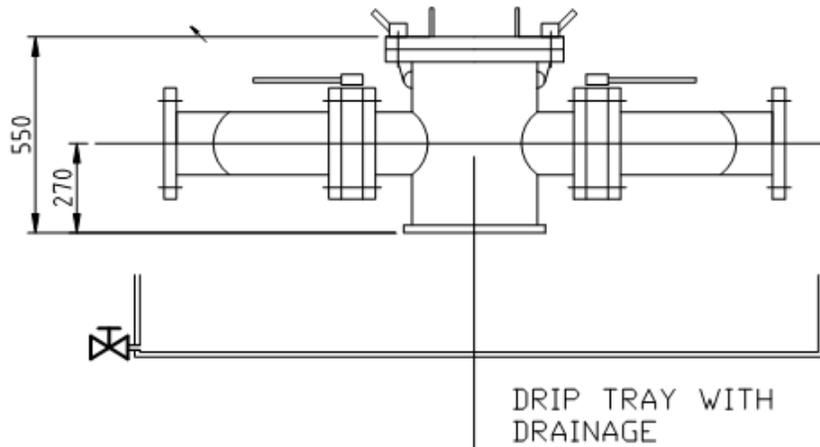
08	17.08.2021	L.A.NERNÆS	J.I.KAROLIUSSEN	E.HABBESTAD			
REV.	DATE	DRAWN BY	VALIDATED BY	APPROVED BY			
 P.O. BOX. 8077 N-4068 STAVANGER TEL: (+47) 51 84 65 60 MAIL: POST@NOFO.NO			TITLE OIL SKIMMER CRANE TRANSREC150 WEIGT 18.8 TON WITH WATER FILLED HOSE				
AUTOCAD FIL			PAPER	SCALE	DRW NUMBER	NUMBER	REVISION
NOFO2021_004			A4	1:1	04	4/11	8



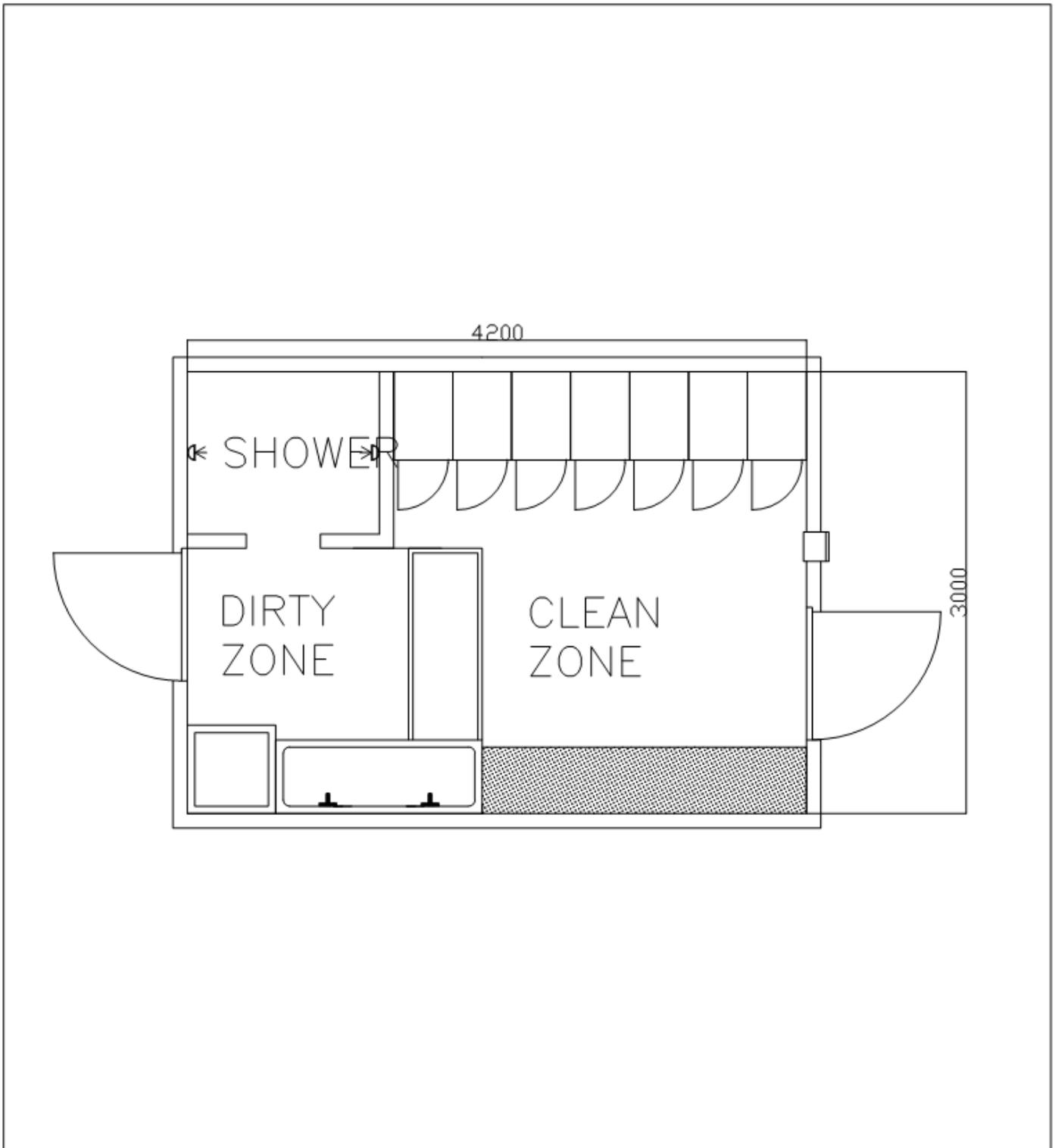
08	17.08.2021	L.A.NERNÆS	J.I.KAROLIUSSEN	E.HABBESTAD			
REV.	DATE	DRAWN BY	VALIDATED BY	APPROVED BY			
P.O. BOX. 8077 N-4068 STAVANGER TEL.: (+47) 51 84 65 60 MAIL: POST@NOFO.NO			TITLE HYDRAULIC SYSTEM PRINCIPLE SKETCH				
AUTOCAD FIL NOFO2021_005			PAPER	SCALE	DRW NUMBER	NUMBER	REVISION
			A4	1:1	05	5/11	8

**NOTE:**

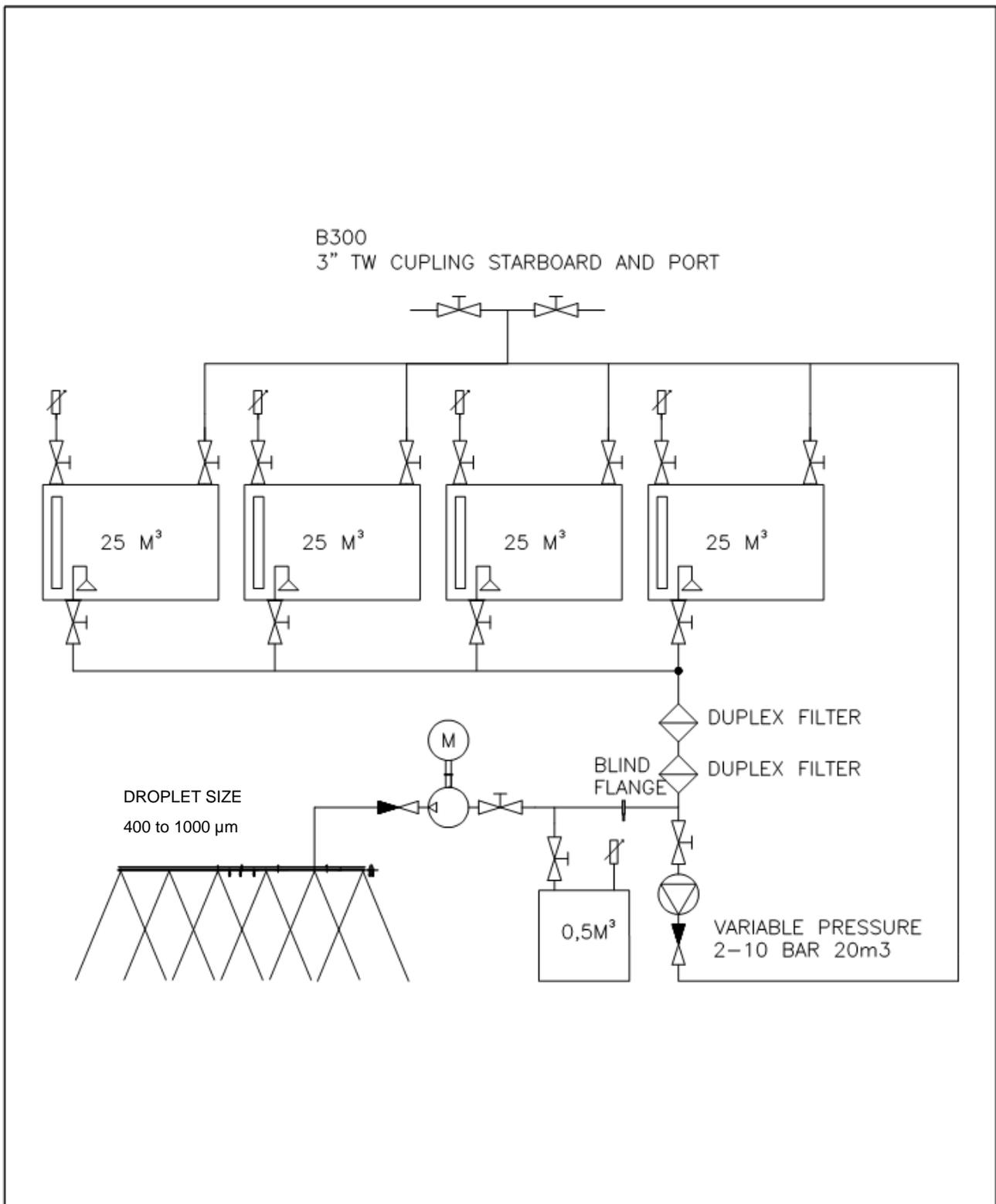
1. FILTER INSERT MUST FOLLOW THE SPECIFICATION TO SUPPLIER OF THE VESSEL'S ORO PUMPS
2. CAPACITY PER FILTER MIN.  $700\text{m}^3 / \text{h v. } 3000\text{cst}$
3. PRESSURE DROP MAX 0.5 BAR
4. STRAINERS SHALL BE EQUIPPED WITH A QUICK-LOCK FOR EASY C



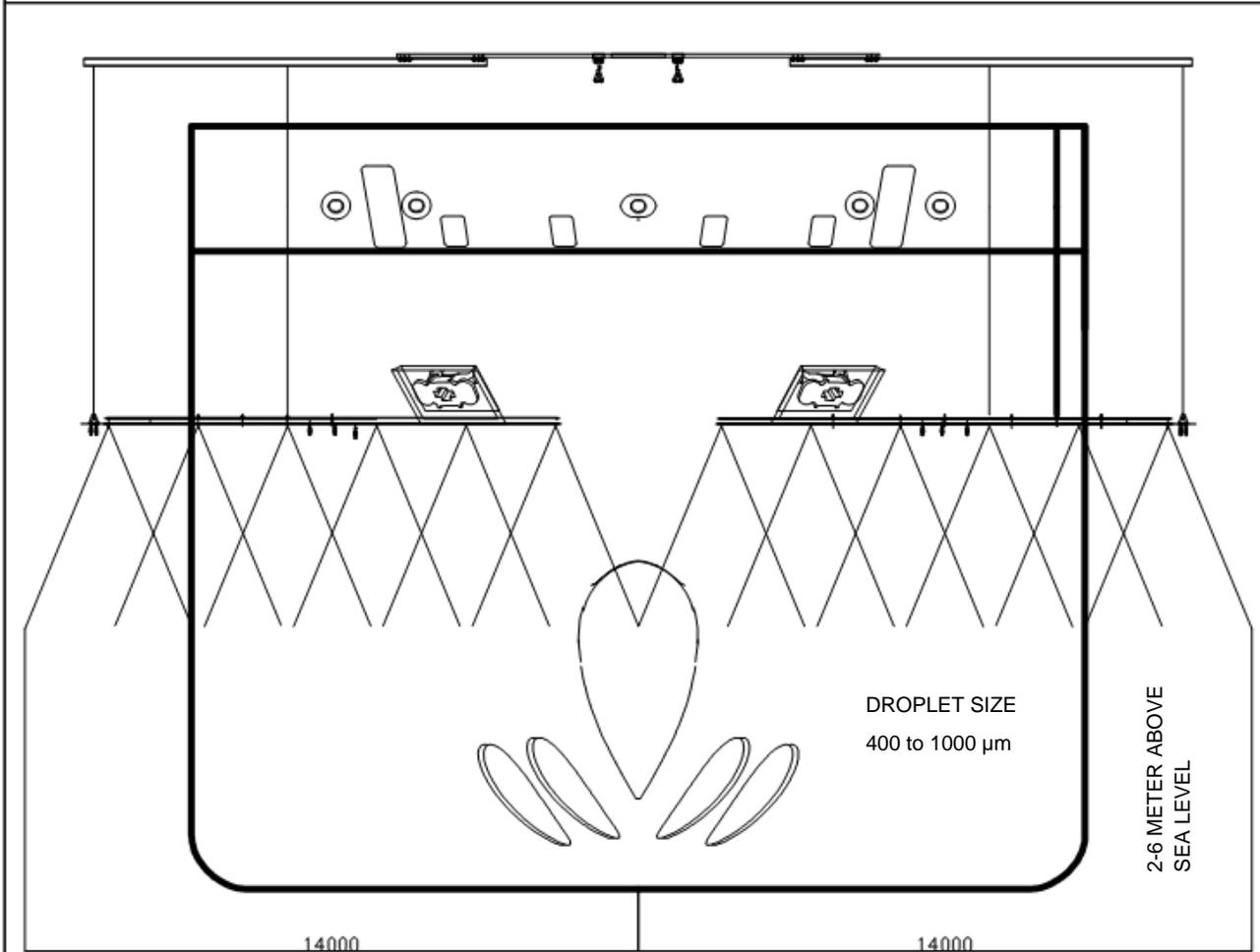
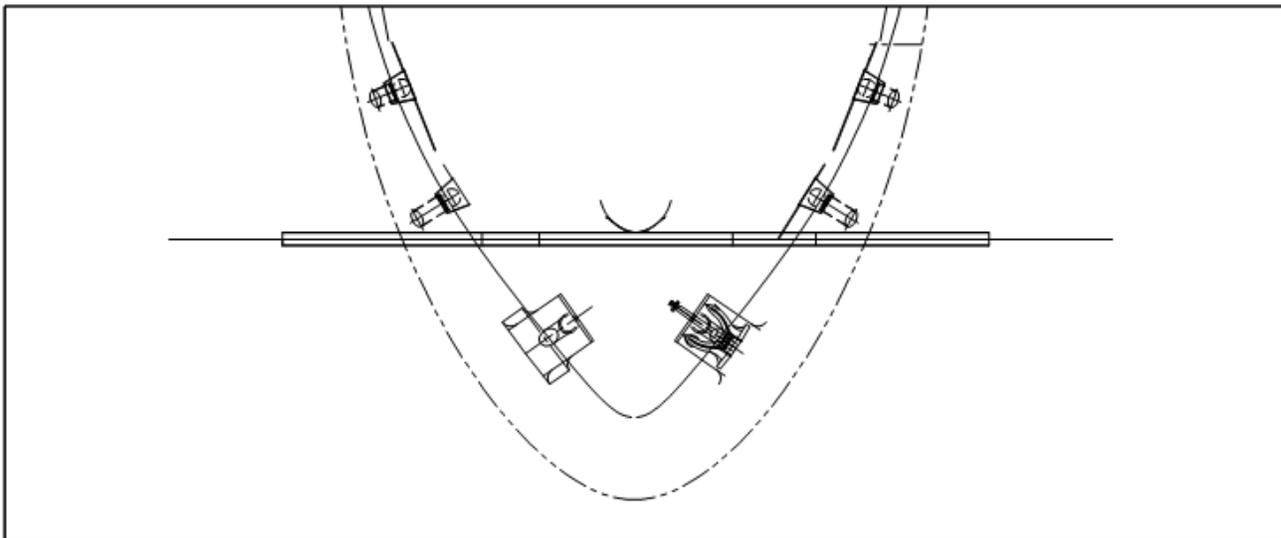
08	17.08.2021	L.A.NERNÆS	J.I.KAROLIUSSEN	E.HABBESTAD			
REV.	DATE	DRAWN BY	VALIDATED BY	APPROVED BY			
 P.O. BOX. 8077 N-4068 STAVANGER TEL.: (+47) 51 84 65 60 MAIL: POST@NOFO.NO			TITLE ORO FILTER ARRANGEMENT				
AUTOCAD FIL			PAPER	SCALE	DRW NUMBER	NUMBER	REVISION
NOFO2021_006			A4	1:1	06	6/11	8



08	17.08.2021	L.A.NERNÆS	J.I.KAROLIUSSEN	E.HABBESTAD			
REV.	DATE	DRAWN BY	VALIDATED BY	APPROVED BY			
 P.O. BOX. 8077 N-4068 STAVANGER TEL.: (+47) 51 84 65 60 MAIL: POST@NOFO.NO			TITLE ORO WARDROBE SKETCH				
AUTOCAD FIL			PAPER	SCALE	DRW NUMBEER	NUMBER	REVISION
NOFO2021_007			A4	1:1	07	7/11	8

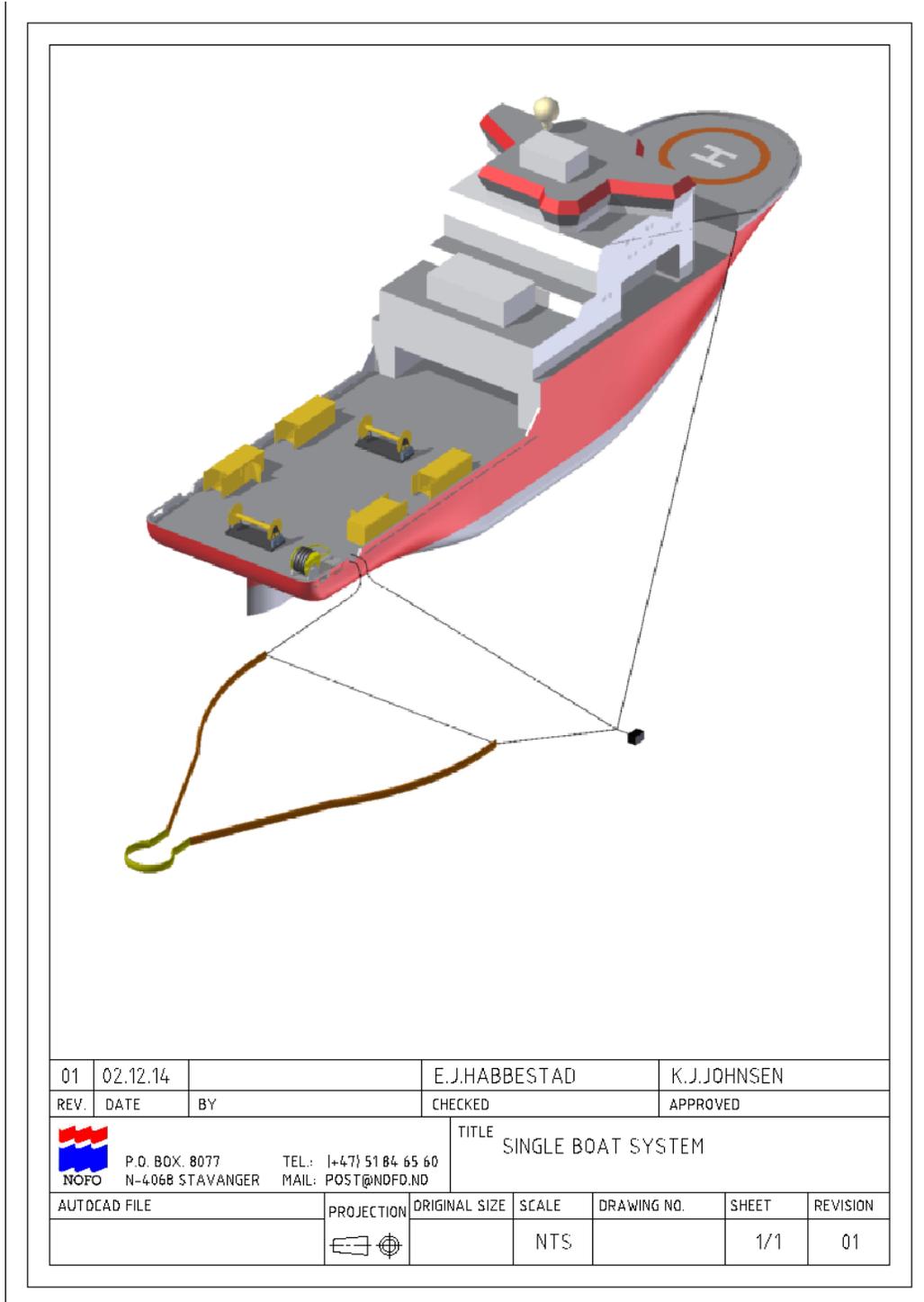


08	16.03.2020	L.A.NERNÆS	J.I.KAROLIUSSEN	E.HABBESTAD			
REV.	DATE	DRAWN BY	VALIDATED BY	APPROVED BY			
P.O. BOX. 8077    TEL.: (+47) 51 84 65 60 N-4068 STAVANGER    MAIL: POST@NOFO.NO			TITTEL <b>PRINCIPLE SKETCH DISPERSION ARRANGEMENT</b>				
			PAPIR	SKALA	TEGNINGSNUMMER.	ARK NR	REVISION
AUTOCAD FIL			A4	1:1	08	8/11	8
NOF02021_08							



08	16.03.2020	L.A.NERNÆS	J.I.KAROLIUSSEN	E.HABBESTAD			
REV.	DATE	DRAWN BY	VALIDATED BY	APPROVED BY			
 P.O. BOX. 8077 N-4068 STAVANGER TEL.: (+47) 51 84 65 60 MAIL: POST@NOFO.NO			TITTEL <b>PRINCIPLE SKETCH DISPERSION ARRANGEMENT</b>				
AUTOCAD FIL			PAPIR	SKALA	DRW NUMBER	ARK NR	REVISION
NOFO2021_09			A4	1:1	09	9/11	1

## APPENDIX C - PRINCIPLE SKETCH – SINGLE BOAT SYSTEM



## APPENDIX D - PRINCIPLE SKETCH - TWO BOAT SYSTEM



01	02.12.14		E.J.HABBESTAD	K.J.JOHNSEN				
REV.	DATE	BY	CHECKED	APPROVED				
P.O. BOX. 8077 N-4068 STAVANGER			TEL: +47 51 84 65 60 MAIL: POST@NOFO.NO					
AUTOCAD FILE			PROJECTION	ORIGINAL SIZE	SCALE	DRAWING NO.	SHEET	REVISION
					NTS		1/1	01

