5 ppm bilge water separators
FOREWORD

DNV GL class programmes contain procedural and technical requirements including acceptance criteria for obtaining and retaining certificates for objects and organisations related to classification.

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SECTION 1 GENERAL

1 Introduction

1.1 Objective
The objective of this class programme (CP) is to give a description for the type approval (TA) of 5 ppm Bilge water separators.

For a description of the DNV GL type approval scheme in general and further information on general conditions and procedures for obtaining DNV GL TA certificate, see class programme CP 0338 - DNV GL Type approval scheme.

The procedures and requirements described in this CP are applicable for obtaining DNV GL TA certificate based on requirements in:

— DNV GL rules RU SHIP Pt.4 Ch.6
— DNV GL rules RU SHIP Pt.6 Ch.7
— Resolution MEPC.107(49) "Revised Guidelines and Specifications for Pollution Prevention Equipment for Machinery Space Bilges of Ships"
— IMO MEPC.1/Circ.643 of 2008-11-12 "Harmonized implementation of the revised guidelines and specifications for pollution prevention equipment for machinery space bilges of ships during the type approval process”.

Guidance note:
This class programme is not applicable for obtaining EU Marine Equipment Directive (MED) certificates. Visit www.dnvgl.com for information on MED certification.

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1.2 Scope
This CP gives a description of the procedures and requirements related to documentation, design and type testing applicable for TA of 5 ppm Bilge water separators.

This CP does not set the design requirements to the 5 ppm Bilge water separators. TA is based on compliance with design requirements given in the DNV GL rules and/or other regulations and standards. The CP describes the applicable design requirements and how to document compliance with the requirements in order to obtain a TA certificate for the equipment. This includes, where relevant, technical requirements for how the type tests shall be performed.

1.3 Application
DNV GL Rules RU SHIP Pt.6 Ch.7 Sec.2 require that 5 ppm Bilge water separators are DNV GL type approved, and TA in accordance with this CP is thus mandatory for equipment to be installed on DNV GL classed vessels with class notation CLEAN(DESIGN).

A TA certificate in accordance with this CP will confirm compliance with the requirements in the DNV GL rules as specified in [1.1]. The TA certificate will not confirm compliance with requirements in other parts of the rules. In case additional requirements in other parts of the rules shall be covered by the TA certificate, this shall be specified in the application for TA and will be stated in the TA certificate.
1.4 Definitions

Table 1 Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 ppm Bilge (water) separator</td>
<td>Any combination of a separator, filter, coalesces or other means, and also a single unit designed to produce an effluent with oil content not exceeding 5 ppm.</td>
</tr>
<tr>
<td>5 ppm Bilge alarm</td>
<td>An oil content meter with associated alarm which is capable of detecting and measuring 5 ppm or less of oil in a ship's bilge water overboard discharge.</td>
</tr>
<tr>
<td>Accredited laboratory</td>
<td>- A European laboratory accredited for all the required tests by an accreditation body being member of European Accreditation, EA.</td>
</tr>
<tr>
<td></td>
<td>- A non-European laboratory accredited by an organisation who has signed a multilateral agreement (MLA) with EA.</td>
</tr>
<tr>
<td></td>
<td>- A laboratory having the quality system audited by DNV GL. A quality audit by DNV GL means that a competent person has gone through the Quality System of the laboratory in accordance with ISO/IEC 17025 (and EN45001) and that a “Statement of Recognition” has been issued.</td>
</tr>
<tr>
<td></td>
<td>- A laboratory recognised/certified by the marine administration of its country, subject to acceptance by the responsible DNV GL approval center. Acceptance shall be obtained before testing commences.</td>
</tr>
<tr>
<td></td>
<td>- any laboratory when testing is witnessed by a qualified surveyor.</td>
</tr>
<tr>
<td></td>
<td>- the manufacturer’s premises provided the test set-up is approved and the testing is witnessed by a qualified surveyor. Such arrangement shall be approved by the responsible DNV GL approval center before testing commences.</td>
</tr>
<tr>
<td>Automatic stopping device</td>
<td>A device used to automatically stop any discharge overboard of oily mixture when the oil content of the effluent exceeds 5 ppm. The automatic stopping device shall consist of a valve arrangement installed in the effluent outlet line of the 5 ppm bilge water separator which automatically diverts the effluent mixture from being discharged overboard back to the ship's bilges or bilge tank when the oil content of the effluent exceeds 5 ppm.</td>
</tr>
<tr>
<td>Bilge water</td>
<td>Water which may be contaminated by oil resulting from incidents such as leakage or maintenance work in machinery spaces. Any liquid entering the bilge system, bilge piping, tank top or bilge holding tanks is considered bilge water.</td>
</tr>
</tbody>
</table>
| Pollution prevention equipment            | 5 ppm Bilge water separator  
Automatic stopping device.                                                                 |
| ppm                                       | Parts of oil per million parts of water by volume.                                                                                       |
| ppm display                               | A numerical scale display of the 5 ppm bilge alarm.                                                                                     |

2 Documentation

For TA of 5 ppm Bilge water separators the following documentation shall be submitted:

- DNV GL application form for TA
- assembly drawings showing main dimensions and equipment arrangement
- mechanical drawings with detailed drawings of all essential mechanical components
- piping diagram including fail-safe arrangements as applicable
- electrical system and instrumentation layout and diagrams and list of components
- description of automatics and fail-safe arrangements, see Sec.2 [1.3]c
- instruction manuals including operation, installation, maintenance and permitted operating parameters
— information regarding the manufacturer’s type designation marking (or other marking) of the product for unambiguous identification of the product with reference to technical specifications
— specification of materials applied
— performance test plan according to App.A and App.C, including laboratory accreditation certificate if test and/or sample analysis is not witnessed by DNV GL, and including model designation of DNV GL type approved 5 ppm bilge alarm to be used during testing
— environmental test plan according to App.B, including laboratory accreditation certificate
— hardware, firmware and software revision information, as applicable, necessary to identify the equipment under test
— reports with results from performance test App.A (and App.C), including model designation of DNV GL type approved 5 ppm bilge alarm used during testing
— reports with results from environmental test (App.B)
— proposed field of application and operational limitations
— drawings of permanent plates giving any operational or installation limits, if any
— hazardous-area (EX) certification documentation as applicable if the equipment shall be certified for hazardous area
— functional description of all essential parts of the equipment
— asbestos-free declaration
— report from initial assessment

The test plans shall be approved prior to testing.

The manufacturer shall provide documentation on all the requirements in this document, not limited to the document list above. The documentation submitted shall be clearly labelled and divided in such a way that all elements below can be easily identified. All drawings and descriptions shall be marked with drawing number, item name, revision no. and/or issue date, etc. The documentation shall be generic drawings suitable for a type approval.

Guidance note:
Where a range of 5 ppm bilge separators of the same design, but of different capacities, shall be type approved in accordance with these specifications, full documentation according to the above list is required for each capacity and will be listed on the certificate. If identical drawings with the same drawing numbers applies to several capacities, this shall be clearly indicated by the manufacturer.

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SECTION 2 PRODUCT REQUIREMENTS

1 Design requirements

1.1 General

The production model of the pollution prevention equipment, for which the approval will apply, shall be identical to the equipment, type-tested and environmental tested in accordance with the test and performance specifications contained in App.A and App.B.

The 5 ppm bilge separator shall be capable of handling any oily mixtures from the machinery space bilges and to be effective over the complete range of oils which might be carried on board ship, and deal satisfactorily with oil of very high relative density, or with a mixture presented to it as an emulsion. Cleansing agents, emulsifiers, solvents or surfactants used for cleaning purposes may cause the bilge water to emulsify. With the possibility of emulsified bilge water always present the 5 ppm bilge separator shall be capable of separating the oil from the emulsion to produce an effluent with an oil content not exceeding 5 ppm.

The 5 ppm bilge alarm shall always be activated when the 5 ppm level is not maintained by the bilge separator, and the automatic stopping device shall then automatically stop the overboard discharge.

The routine maintenance permitted operating parameters and procedures for the 5 ppm bilge separator shall be clearly defined by the manufacturer in the associated operation, installation and maintenance manual.

1.2 Automatic stopping device

The automatic stopping device is a device used, where applicable, to automatically stop any discharge overboard of oily mixture when the oil content of the effluent exceeds 5 ppm. The automatic stopping device shall consist of a valve arrangement installed in the effluent outlet line of the 5 ppm bilge separator which automatically diverts the effluent mixture from being discharged overboard back to the ship’s bilges or bilge tank when the oil content of the effluent exceeds 5 ppm.

1.3 Specific requirements to 5 ppm bilge separator

1.3.1 The 5 ppm bilge separator shall be strongly constructed and suitable for shipboard use, bearing in mind its intended location on the ship.

1.3.2 It shall, if intended to be fitted in locations where flammable atmospheres may be present, comply with the relevant safety regulations for such spaces. Any electrical equipment which is part of the 5 ppm bilge separator shall be based in a non-hazardous area, or shall be certified as safe for use in a hazardous area. Any moving parts which are fitted in hazardous areas shall be arranged so as to avoid the formation of static electricity.

1.3.3 The 5 ppm bilge separator shall be so designed that it functions automatically. However, fail-safe arrangements to avoid any discharge in case of malfunction shall be provided.

The requirements to automatics and fail-safe are:

1) The alarm is always activated whenever clean water is used for cleaning or zeroing purposes.
2) The alarm is always activated whenever no flow of sample through the oil-content meter is detected by the flow sensor.
3) Any alarm will activate the automatic stopping device and lead to recirculation.
4) The overall response time (including the response time of the alarm) between an effluent discharge exceeding 5 ppm oil and the automatic stopping device preventing the overboard discharge is less than 20 s.
5) By-passing the alarm during normal operation shall by no means be possible.
6) Every access of the alarm (beyond check on instrument drift, repeatability of the instrument reading, and the ability to re-zero the instrument) requires the breaking of a seal.

1.3.4 Changing the feed to the 5 ppm bilge separator from bilge water to oil, bilge water to emulsified bilge water, or from oil and/or water to air shall not result in the discharge overboard of any mixture containing more than 5 ppm of oil.

1.3.5 The system shall require the minimum of attention to bring it into operation. In the case of equipment used for engine room bilges, there shall be no need for any adjustment to valves and other equipment to bring the system into operation. The equipment shall be capable of operating for at least 24 hours of normal duty without attention. Therefore, the complete performance test according to App.A with the test fluids A, B, and C shall be performed in series, without interruption to attend, clean or maintain the bilge separator. This way, the test is regarded as a simulation of the 24 hours of unattended operation not requiring any crew attention.

1.3.6 All working parts of the 5 ppm bilge separator which are liable to wear or to damage shall be easily accessible for maintenance.

1.3.7 5 ppm bilge separator shall be tested according to and comply with test and performance requirements of App.A and App.B.

1.3.8 5 ppm bilge separator must be designed to operate in each plane that forms an angle of 22.5° with the plane of its normal operating position, and this shall be verified through the test requirements in App.A [2.9] 6).

2 Test requirements

The 5 ppm bilge separator shall undergo the following prototype tests:

a) Performance test according to App.A with oil-content analysis according to App.C.
b) Environmental test according to App.B.

All test reports shall include the type designation or model identification of the equipment tested, capacity, serial number, as well as hardware, firmware and software revision information, as applicable, necessary to identify the equipment under test.

It is the manufacturer's responsibility to ensure that the testing is performed according to the requirements in this Type Approval Programme.

Guidance note:
Where a range of 5 ppm bilge separators of the same design, but of different capacities, are to be type approved in accordance with these specifications, full performance testing (App.A and App.C) of minimum two capacities within the range may be accepted, in lieu of tests of every size, on the condition that the two tests performed are from the lowest quarter and highest quarter of the capacity range. Environmental testing (App.B) shall be performed as testing worst-case in the range.

3 Limitations on the certificate

3.1

If the bilge separator is fitted with heating facilities to allow the separated oil retained in it to be discharged when the automatic discharge valves is activated, the following limitation will be included in the certificate: "The 5 ppm bilge separator is fitted with heating facility".
3.2
If the separator is not of EX certified safe type, the following limitation will be included in the certificate:
"Installation of the equipment in spaces subject to explosion hazard is not permitted."

4 Product marking
The final product shall be provided with visible marking, which completely identifies the product and its components according to drawings/equipment specification.
The marking shall give at least the following information:
— identification of manufacturer
— equipment type designation or model identification
— maximum throughput and maximum influent pressure at which the separator is designed to operate
— serial number
— revision information, as applicable, for all firmware or software modules installed per hardware unit, necessary to identify the equipment, permanently marked somewhere on the final product.

5 Installation requirements to 5 ppm bilge separator

5.1
For future inspection purposes on board ship, a sampling point shall be provided in a vertical section of the water effluent piping as close as is practicable to the 5 ppm bilge separator outlet. Re-circulating facilities shall be provided, after and adjacent to the overboard outlet of the stopping device to enable the 5 ppm bilge separator system, including the 5 ppm bilge alarm and the automatic stopping device, to be tested with the overboard discharge closed (see Figure 1). The re-circulating facility shall be so configured as to prevent under all operating conditions any by-pass of the bilge separator.

![Figure 1 Typical on board arrangement of 5 ppm bilge separator, 5 ppm bilge alarm and automatic stopping device](image-url)
5.2
The capacity of the supply pump shall not exceed 110% of the rated capacity of the 5 ppm bilge separator with size of pump and motor to be stated on the certificate of type approval.

5.3
The 5 ppm bilge separator shall be fitted with a permanently attached plate giving any operational or installation limits considered necessary by the manufacturer or the classification society.

5.4
A vessel fitted with a 5 ppm bilge separator shall, at all times, have on board a copy of the operation, installation and maintenance manual.

6 Installation requirements to 5 ppm bilge water system

6.1
The layout of the installation shall be arranged so that the overall response time (including the response time of the 5 ppm bilge alarm) between an effluent discharge from the 5 ppm bilge separator exceeding 5 ppm, and the operation of the automatic stopping device preventing overboard discharge, shall be as short as possible and in any case not more than 20 s.

6.2
The arrangement on board ship for the extraction of samples from the 5 ppm bilge separator discharge line to the 5 ppm bilge alarm shall give a truly representative sample of the effluent with an adequate pressure and flow.
APPENDIX A TEST AND PERFORMANCE SPECIFICATIONS FOR TYPE APPROVAL OF 5 PPM BILGE SEPARATORS

1 General

1.1
These test and performance specifications for type approval relate to 5 ppm bilge separators. The oil content of the samples shall be determined in accordance with App.C.
The test report shall include model name, capacity and serial number of separator, and revision information of all software/firmware modules.
The test report shall include model designation of DNV GL type approved 5 ppm bilge alarm used during testing.

1.2
The 5 ppm bilge separator being tested shall comply with the relevant requirements of the specific requirements contained in Sec.2 [1.3].
The complete performance test according to App.A with the test fluids "A", "B", and "C" shall be performed in series, without interruption to attend, clean or maintain the bilge separator. Compliance with this requirement shall be reflected in the final performance test report.

2 Test specifications

2.1
These specifications relate to 5 ppm bilge separators. 5 ppm bilge separators shall be capable of producing an effluent for discharge to the sea containing not more than 5 ppm of oil irrespective of the oil content of the feed supplied to it.

2.2
The influent, whether emulsified or non-emulsified, which the system has in practice to deal with, depends on:
— the position of the oil/water interface, with respect to the suction point, in the space being pumped
— the type of pump used
— the type and degree of closure of any control valve in the circuit
— the general size and configuration of the system.
Therefore the test rig must be so constructed as to include not only the 5 ppm bilge separator, but also the pumps, valves, pipes and fittings as shown in Figure 1. It is to be so designed for testing 5 ppm bilge separators with and without an integral supply pump.

a) For the testing of 5 ppm bilge separators having no integral pump, the centrifugal pump “A” (see Figure 1) is used to feed the 5 ppm bilge separator with valves 4 and 6 open, and valve 5 closed. The rate of flow from the centrifugal pump “A” is matched to the design throughput of the 5 ppm bilge separator by the adjustment of the centrifugal pump’s discharge valve.
b) Where the 5 ppm bilge separator is fitted with an integral pump, the centrifugal pump “A” is not required.
c) A centrifugal pump “B” shall be fitted to re-circulate the test fluid C in the tank to ensure that the Test Fluid C is maintained in a stable condition throughout the testing. Re-circulation is not required for Test Fluids A and B.

d) To ensure a good mix of the test fluid and the water, a conditioning pipe as specified in [2.5] shall be fitted immediately before the 5 ppm bilge separator.

e) Other valves, flow meters and sample points shall be fitted to the test rig as shown in Figure 1.

f) The pipe work shall be designed for a maximum liquid velocity of 3 m/s.

**Figure 1 Test rig**

2.3

The tests shall be carried out with a supply rate equal to the full throughput for which the 5 ppm bilge separator is designed.

2.4

Tests shall be performed using three grades of test fluids:

1) Test fluid “A” which is a marine residual fuel oil in accordance with ISO 8217, type RMG 35 (density at 15°C not less than 980 kg/m³)

2) Test fluid “B” which is a marine distillate fuel oil in accordance with ISO 8217, type DMA (density at 15°C not less than 830 kg/m³).

3) Test fluid “C” which is a mixture of an oil-in-fresh water emulsion, in the ratio whereby 1 kg of the mixture consists of:
   - 947.8 g of fresh water
   - 25.0 g of test fluid “A”
   - 25.0 g of test fluid “B”
— 0.5 g surfactant (sodium salt of dodecylbenzene sulftonic acid) in the dry form
— 1.7 g “iron oxides” (The term “iron oxide” is used to describe black ferrosferric oxide (Fe$_3$O$_4$) with a particle size distribution of which 90% is less than 10 microns, the remainder having a maximum particle size of 100 microns).

**Guidance note:**

Procedure for preparing test fluid “C”: (see example calculation)*

* Calculation of ingredients of test fluid “C” (Example: 2 m$^3$/h bilge separator).

Operating period for the test with test fluid “C” as per [2.11]:

2.5 hours plus conditioning time (say 0.5 hour) = 3 hours

Net volume needed for the test:

Volume of test water: 2 m$^3$/h × 3 hours = 6 m$^3$

Volume test fluid “C”: 6% of test water = 0.06 × 6 m$^3$ = 0.36 m$^3$

Actual volume to be prepared:

Volume of test fluid “C” to be prepared: 1.2 times the net volume of test fluid “C” = 1.2 × 0.36 = 0.432 m$^3$

Volume of fresh water in test fluid “C”: (947.8 g/1000 g) of test fluid “C” = 0.9478 × 0.432 = 0.4094 m$^3$

Weight of test fluid “A”: (25 g/1000 g) of test fluid “C” = 25/1000 × 0.432 × 1000 = 10.8 kg

Weight of test fluid “B”: (25 g/1000 g) of test fluid “C” = 25/1000 × 0.432 × 1000 = 10.8 kg

Weight of surfactant: (0.5 g/1000 g) of test fluid “C” = 0.5/1000 × 0.432 × 1000 = 0.216 kg

Weight of iron oxide: (1.7 g/1000 g) of test fluid “C”) = 1.7/1000 × 0.432 × 1000 × 0.734 kg

---end---of---guidance---note---

2.4.1 Preparation

1) Measure out 1.2 times the quantity of surfactant required for the “Test with test fluid C” as described in [2.11] , and

2) Mix it with fresh water and stir well in a small container (e.g., a beaker or bucket) to make a mixture (“Mixture D”) until the surfactant has been thoroughly dissolved.

2.4.2 To make test fluid C in the test fluid tank (see Figure 2)

1) Fill test fluid tank with fresh water with a quantity 1.2 times the volume of the total quantity of water in the test fluid “C” needed for the test described in [2.11].

2) Operate centrifugal pump B running at a speed of not less than 3000 rpm (nominal) with a flow rate at which the volume of the test fluid has been changed out at least once per minute.

3) Add “Mixture D” first, followed by oil and suspended solids (iron oxides) respectively, both 1.2 times of the required amounts, to the fresh water in the tank,

4) To establish a stable emulsion keep running the centrifugal pump B for one hour and confirm no oil floats on the surface of the test fluid.

5) After the one hour stated in paragraph (4) above keep running the centrifugal pump B at reduced speed to approximately 10% of original flow rate, until the end of the test.
Guidance note:

1) The tank shall be of a cylindrical shape. The level of the water shall be: $2D > H > 0.5D$, when preparing test fluid "C".
2) Outlet going to centrifugal pump B shall be placed at as low a position to the tank as possible.
3) Inlet to the tank shall be fitted at the centre of tank bottom so that the mixture flows upward to obtain uniform and stable emulsion.

If the 5 ppm bilge separator is fitted with heating facilities to allow the separated oil retained in it to be discharged when the automatic discharge valve is activated, the certificate of type approval shall be endorsed under the heading "Application/Limitation" with the following statement:

"The 5 ppm separator is fitted with heating facility".

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2.5

If the 5 ppm bilge separator includes an integrated feed pump, this 5 ppm bilge separator shall be tested with that pump supplying the required quantity of test fluid and water to the 5 ppm bilge separator at its rated capacity.

If the 5 ppm bilge separator is to be fed by the ship's bilge pumps, then the unit will be tested by supplying the required quantity of test fluid and water mixture to the inlet of a centrifugal pump operating at not less than 1000 rpm (see dotted line in Figure 1). This pump shall have a delivery capacity of not less than 1.1 times the rated capacity of the 5 ppm bilge separator at the delivery pressure required for the test. The variation in Test Fluid/water ratio will be obtained by adjusting valves on the test fluid and water suction pipes adjacent to the pump suction, and the flow rate of test fluid and water or the test fluid content of the supply to the 5 ppm bilge separator shall be monitored. If a centrifugal pump is used, the excess pump capacity shall be controlled by a throttle valve on the discharge side of the pump.

In all cases, to ensure uniform conditions, the piping arrangements immediately prior to the 5 ppm bilge separator shall be such that the influent to the 5 ppm bilge separator shall have a Reynolds Number of not less than 10 000 as calculated in fresh water, a liquid velocity of not less than 1 m/s and the length of the supply pipe from the point of test fluid injection to the 5 ppm bilge separator shall have a length not less than 20 times its diameter. A mixture inlet sampling point and a thermometer pocket shall be provided near
the 5 ppm bilge separator inlet and an outlet sampling point and observation window shall be provided on the discharge pipe.

2.6

In order to approach isokinetic sampling - i.e. the sample enters the sampling pipe at stream velocity - the sampling arrangement shall be as shown in Figure 3 and, if a cock is fitted, free flow shall be effected for at least one minute before any sample is taken. The sampling points shall be in pipes running vertically.

A - distance A, not greater than 400mm  
B - distance B, sufficient to insert sampling bottle  
C - dimension C, straight length shall not be less than 60mm  
D - dimension D, pipe thickness shall not be greater than 2mm  
E - detail E, chisel-edged chamfer (30º)

Figure 3 Diagram of sampling arrangements

2.7

In the case of the 5 ppm bilge separator depending essentially on gravity, the feed to the system of the test water and test fluid mixture shall be maintained at a temperature not greater than 40°C, and heating and cooling coils shall be provided where necessary. The water shall have a density of not more than 1.015 at 20°C. In other forms of separation where the dependence of separation efficiency on temperature is not established, tests shall be carried out over a range of influent temperatures representing the normal shipboard operating range of 10°C to 40°C or shall be taken at a temperature in this range where the separation efficiency is known to be worst.

2.8

In those cases where, for the 5 ppm bilge separator, it is necessary to heat water up to a given temperature and to supply heat to maintain that temperature, the tests shall be carried out at the given temperature.
If the preheating of the feed is necessary for the proper functioning of the 5 ppm bilge separator, then
the preheater shall be the part of the unit at testing. The range of the pre-heater outlet temperature shall
be defined and stated in the type approval certificate and automatic operation of the pre-heater shall be
arranged.

2.9

The tests with test fluid “A” shall be carried out as follows:

1) To ensure that the 5 ppm bilge separator commences the test with the oil section full of test fluid and
with the supply line impregnated with test fluid, the 5 ppm bilge separator shall, after filling with water
(density at 20° C not more than 1.015) and while in the operating condition, be fed with pure test fluid
for not less than 5 min.

2) The 5 ppm bilge separator shall be fed with a mixture composed of between 5000 and 10 000 ppm of
test fluid in water until steady conditions have been established. Steady conditions are assumed to be
the conditions established after pumping through the 5 ppm bilge separator a quantity of test fluid/water
mixture not less than twice the volume of the 5 ppm bilge separator. The test shall then proceed for
30 min. Samples shall be taken at the effluent outlet at 10 min and 20 min from the start of this period.
At the end of this test, an air cock shall be opened on the suction side of the pump and, if necessary, the
oil and water valves shall be slowly closed together, and a sample taken at the effluent discharge as the
flow ceases (this point can be checked from the observation window).

3) A test identical to that described in item 2), including the opening of the air cock, shall be carried out
with a mixture composed of approximately 25% (by volume) test fluid and 75% (by volume) water.

4) The 5 ppm bilge separator shall be fed with 100% (by volume) of test fluid for at least 5 min during
which time the observation window shall be checked for any oil discharge. Sufficient test fluid shall be
fed into the 5 ppm bilge separator to operate the automatic oil discharge valve. After the operation of
the oil discharge valve, the test shall be continued for 5 min using a 100% (by volume) test fluid supply
in order to check the sufficiency of the oil discharge system.

5) The 5 ppm bilge separator shall be fed with water (density at 20°C not more than 1.015) for 15 min.
Samples of the separated water effluent are taken at the beginning of the test and after the first 10 min.

6) A test lasting a minimum of 2 h shall be carried out to check that the 5 ppm bilge separator will operate
continuously and automatically. This trial shall use a cycle varying progressively from water to oily
mixture with approximately 25% (by volume) test fluid content and back to water every 15 minutes, and
shall test adequately any automatic device which is fitted. The whole test sequence shall be performed
as a continuous programme.

During the last hour, the separator must be inclined at an angle of 22.5° with the plane of its normal
operating position. At the end of the test, while the 5 ppm bilge separator is being fed with 25% (by
volume) test fluid, a water effluent sample shall be taken for analysis.

The 5 ppm bilge separator shall operate continuously and automatically without any interruptions.

7) It shall be assured that back flushing if performed during the certification test does not cause:

— dilution of the test fluids A, B, or C, or
— dilution of the test sample sent to the laboratory for analysis.

8) If input flow of the test fluid is interrupted during the performance of the test it shall be assured that the
total quantities of the test fluids A, B, and C processed automatically are not less than the nominal flow
of the separator multiplied by the specified test duration for each fluid.

9) At all times, it shall be assured that the bilge separator operates continuously and automatically without
human intervention.

Guidance note:
The internal fluid transfer in case of inclusion of a pre-treatment module could be as batches as long as the overall process is
continuous and automatic.
2.10
The tests with test fluid “B” shall be carried out as follows:

1) The 5 ppm bilge separator shall be fed with a mixture composed of between 5000 and 10 000 ppm of test fluid in water until steady conditions have been established. Steady conditions are assumed to be the conditions established after pumping through the 5 ppm bilge separator a quantity of test fluid/water mixture not less than twice the volume of the 5 ppm bilge separator. The test shall then proceed for 30 min. Samples shall be taken at the effluent outlet at 10 min and 20 min from the start of this period. At the end of this test, an air cock shall be opened on the suction side of the pump and, if necessary, the oil and water valves shall be slowly closed together, and a sample taken at the effluent discharge as the flow ceases (this point can be checked from the observation window).

2) A test identical to that described in 1), including the opening of the air cock, shall be carried out with a mixture composed of approximately 25% (by volume) test fluid and 75% (by volume) water.

2.11
The tests with test fluid “C” shall be carried out as follows:

1) The 5 ppm bilge separator shall be fed with a mixture composed of 6% test fluid “C” and 94% water to have emulsified oil content of 3000 ppm in the test water until steady conditions have been established. Steady conditions are assumed to be the conditions established after pumping through the 5 ppm bilge separator a quantity of test fluid “C”/water mixture not less than twice the volume of the 5 ppm bilge separator.

2) The test shall then proceed for 2.5 h. Samples shall be taken at the effluent outlet at 50 minutes and 100 minutes after conditioning. At the end of this test, an air cock shall be opened on the suction side of the pump and, if necessary, the test fluid “C” and water valves shall be slowly closed together, and a sample taken at the effluent discharge as the flow ceases (this point can be checked from the observation window).

2.12
Sampling shall be carried out as shown in Figure 3 so that the sample taken will suitably represent the fluid issuing from the effluent outlet of the 5 ppm bilge separator.

2.13
Samples shall be taken in accordance with ISO 9377- 2:2000. The sample is to be extracted on the same day of collection, and be sealed and labelled in the presence of surveyor and arrangements shall be made for analysis as soon as possible and in any case within seven days provided the samples are being kept between 2°C and 6°C at the accredited laboratory.

2.14
The oil content of the samples shall be determined in accordance with App.C.

2.15
When accurate and reliable DNV GL type-approved 5 ppm oil content meters are fitted at inlet and outlet of the 5 ppm bilge separator, one sample at inlet and outlet taken during each test will be considered sufficient if they verify, to within ± 10%, the meter readings noted at the same instant.
2.16

In the presentation of the results, the following data testing methods and readings shall be reported:

1) Properties of test fluids A and B:
   — density at 15°C
   — kinematic viscosity (centistokes at 100°C/40°C)
   — flashpoint
   — ash
   — water content.

2) Properties of test fluid C:
   — type of surfactant
   — particle size percentage of the non soluble suspended solids; and
   — surfactant and iron oxide quality verification.

3) Properties of the water in the water tank:
   — density of water at 20°C
   — details of any solid matter present.

4) Temperature at the inlet to the 5 ppm bilge separator.

5) A diagram of the test rig.

6) A diagram of the sampling arrangement.

7) The method used in analysis of all samples taken and the results thereof, together with oil content meter.

8) Readings, where appropriate.

9) Confirmation that changing feed from bilge water to oil, from bilge water to emulsified bilge water, or from oil and/or water to air does not result in the discharge > 5 ppm.
APPENDIX B SPECIFICATIONS FOR ENVIRONMENTAL TESTING FOR TYPE APPROVAL OF 5 PPM BILGE SEPARATORS

1 General
The specifications for environmental testing for type approval relate to the electrical and electronic sections of 5 ppm bilge separator (hereafter referred to as “equipment”).

All electrical and electronic components of the 5 ppm separator shall be tested in accordance with [2]. Satisfactory compliance with the environmental tests laid down here, where applicable, shall be shown on the environmental test protocol issued by the accredited testing laboratory. The protocol shall include at least a statement of the tests conducted on the equipment, including the results thereof. The protocol shall be signed and dated by the person in charge of the laboratory. The test report shall include model name, capacity and serial number of separator, and revision information of all software/firmware modules.

2 Test specifications

2.1 Testing requirements
The electrical and electronic sections of the equipment in the standard production configuration shall be subjected to the programme of environmental tests set out in this specification at the accredited laboratory. A copy of the environmental test document, in a format similar to that specified in [1], shall be submitted to The Society by the manufacturer, together with the application for type approval.

2.2 Test specification details
Equipment shall operate satisfactorily on completion of each of the following environmental tests:

2.2.1 Vibration tests:
1) A search shall be made for resonance over the following range of frequency and amplitude of acceleration:
   a) 2 to 13.2 Hz with an amplitude of ± 1mm
   b) 13.2 to 80 Hz with an acceleration of ± 0.7 g. This search shall be made in each of the three planes at a rate sufficiently low to permit detection of resonance.
2) The equipment shall be vibrated in the planes at each major resonant frequency for a period of 2 hours.
3) If there is no resonant frequency, the equipment shall be vibrated in each of the planes at 30 Hz with an acceleration of ± 0.7 g for a period of 2 hours.
4) After completion of the tests specified in 2) or 3) a search shall again be made for resonance and there shall be no significant change in the vibration pattern.

2.2.2 Temperature tests (procedure according to IEC60068-2-2 Tests Bb, Bd)
1) Equipment that may be installed in an enclosed space that is environmentally controlled, including an engine-room, shall be subjected, for a period of not less than 2 h, to:
   a) a low temperature test at 0°C
   b) a high temperature test at 55°C.
2) At the end of each of the tests referred to, the equipment shall be switched on and it shall function normally under the test conditions.
2.2.3 Humidity tests
Equipment shall be left switched off for a period of 2 h at a temperature of 55°C in an atmosphere with a relative humidity of 90%. At the end of this period the equipment shall be switched on and shall operate satisfactorily for 1 hour (First the temperature test of the electronic part shall be operated under the test condition mentioned under [2.2.2], followed by the humidity test.)

2.2.4 Inclination test
Equipment shall operate satisfactorily at angles of inclination up to 22.5° in any plane from the normal operating position.

2.2.5 Reliability of electrical and electronic equipment
The electrical and electronic components of the equipment shall be of a quality guaranteed by the manufacturer and suitable for their intended purpose.
APPENDIX C METHOD FOR DETERMINATION OF OIL CONTENT

1 Scope and application

The International Standard ISO 9377-2:2000 “Water quality - Determination of hydrocarbon oil index - Part 2: Method using solvent extraction and gas chromatography” specifies a method for the sampling and subsequent determination of the hydrocarbon oil index in water using solvent extraction and gas chromatography. This method shall be used for the determination of oil content requirements outlined in this programme.
APPENDIX D FORMS FOR TEST DATA AND RESULTS

1 General
Test data and results of tests conducted on a 5 ppm bilge separator in accordance with App.A and App.C to the DNV GL type approval programme of 5 ppm bilge water separators.

2 Oil-content analysis

<table>
<thead>
<tr>
<th>Manufacturer of 5 ppm bilge separator</th>
<th>Test location</th>
<th>Date of test</th>
<th>Samples sealed and labelled by</th>
<th>Method of sample analysis</th>
<th>Samples analysed by</th>
</tr>
</thead>
</table>

3 Test fluids data

<table>
<thead>
<tr>
<th>Test fluid “A”</th>
<th>Density at 15°C</th>
<th>Viscosity Centistokes at 100°C</th>
<th>Flashpoint ºC</th>
<th>Ash content %</th>
<th>Water content at start of test %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test fluid “B”</td>
<td>Density at 15°C</td>
<td>Viscosity Centistokes at 40°C</td>
<td>Flashpoint ºC</td>
<td>Ash content %</td>
<td>Water content at start of test %</td>
</tr>
<tr>
<td>Test fluid “C”</td>
<td>Surfactant - documentary evidence*</td>
<td>Iron oxides - documentary evidence*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Certificate or laboratory analysis.
<table>
<thead>
<tr>
<th>Test water</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Density at 20°C</td>
<td></td>
</tr>
<tr>
<td>Solid matter present</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test temperatures</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambient</td>
<td>0°C</td>
</tr>
<tr>
<td>Test fluid “A”</td>
<td>0°C</td>
</tr>
<tr>
<td>Test fluid “B”</td>
<td>0°C</td>
</tr>
<tr>
<td>Test fluid “C”</td>
<td>0°C</td>
</tr>
<tr>
<td>Test water</td>
<td>0°C</td>
</tr>
</tbody>
</table>

4 Test rig and sampling arrangement

- Diagram of test rig submitted
- Diagram of sampling arrangement submitted

5 Test results (in ppm) and test procedures
Instructions:
The continuous and automatic operation shall apply to the performance tests with the test fluids A, B and C according to the test result diagrams. However if due to the separation process any interruption in feeding the test fluid with nominal flow rate e.g., for back flushing, is deemed necessary, the time for these interruptions shall be added to the required time of the test step which was interrupted during the performance test. At all times, the bilge separator shall operate continuously and automatically without human intervention.
CHANGES – HISTORIC

There are currently no historical changes for this document.
Driven by our purpose of safeguarding life, property and the environment, DNV GL enables organizations to advance the safety and sustainability of their business. We provide classification and technical assurance along with software and independent expert advisory services to the maritime, oil and gas, and energy industries. We also provide certification services to customers across a wide range of industries. Operating in more than 100 countries, our 16,000 professionals are dedicated to helping our customers make the world safer, smarter and greener.