ANNEX 10

Resolution MEPC.60(33)
adopted on 30 October 1992

GUIDELINES AND SPECIFICATIONS FOR POLLUTION PREVENTION EQUIPMENT FOR MACHINERY SPACE BILGES OF SHIPS

THE MARINE ENVIRONMENT PROTECTION COMMITTEE,

RECALLING Article 38(a) of the Convention on the International Maritime Organization concerning the functions of the Committee,

NOTING resolution A.393(X) by which the Assembly adopted the Recommendations on International Performance and Test Specifications for Oily-Water Separating Equipment and Oil Content Meters and invited Governments to adopt and apply them to the maximum possible extent which they found reasonable and practicable and to report to the Organization the results of such application, and also invited the Committee to review the Guidelines and Specifications at an appropriate time,

NOTING FURTHER the provisions of regulation 16(5) of Annex I of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 relating thereto (MARPOL 73/78), in which reference is made to the above-mentioned specifications,

RECOGNIZING the advancement of technology, as well as the amendments to Annex I of MARPOL 73/78 on its operational discharge requirements which were adopted by the Marine Environment Protection Committee in 1992 and which are expected to enter into force on 6 July 1993,

HAVING CONSIDERED, at its thirty-third session, the revised Guidelines and Specifications developed in the light of the requirements of Annex I of MARPOL 73/78,

1. ADOPTS the Guidelines and Specifications for Pollution Prevention Equipment for Machinery Space Bilges of Ships, the text of which is set out at annex to this resolution, which supersedes the recommendations contained in resolution A.393(X);

2. INVITES Governments to:

(a) adopt the new revised Guidelines and Specifications and apply them so that all equipment installed on board on or after 30 April 1994 meets these revised Guidelines and Specifications in so far as is reasonable and practicable; and

(b) provide the Organization with information on experiences gained from their application and, in particular, on successful testing of equipment against the Specifications;

3. REQUESTS the Secretariat, on the basis of information received, to maintain and update a list of approved equipment and to circulate it once a year to Governments;

4. FURTHER INVITES Governments to issue an appropriate "Certificate of Type Test" as referred to in paragraph 5.2.1 of the Specifications and to recognize such certificates issued under the authority of other Governments as having the same validity as certificates issued by them.

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GUIDELINES AND SPECIFICATIONS FOR POLLUTION PREVENTION EQUIPMENT FOR MACHINERY SPACE BILGES OF SHIPS

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1 INTRODUCTION

1.1 General

1.1.1 The specifications in respect of oil filtering equipment are considered to be applicable for use in conjunction with oily bilge-water and ballast water from fuel oil tanks, as these are of a low or medium capacity, and are conditioned by the need to avoid discharging oily mixtures with an oil content more than 15 ppm of the mixture.

1.1.2 It is recognized that the development and testing of high capacity separating equipment designed for dealing with effluent from cargo tanks on tankers pose special problems and such equipment does not require to be tested under these specifications. Such development and tests should not be hindered and Administrations should be prepared to accept deviations from these specifications when they are considered necessary in this context.

1.1.3 It should be understood that a gravitational filtering equipment cannot be expected to be effective over the complete range of oils which might be carried on board ship, nor can it deal satisfactorily with oil of very high relative density or with a mixture presented to it as an emulsion. Cleansing agents used for cleaning purposes in machinery spaces may cause these emulsions in bilge water. To avoid this, only those cleansing agents which do not affect the performance of the equipment should be used, and care should be taken that the bilge water is fed to the filtering equipment after the emulsion has broken. Considering that not all designs of equipment are affected in the same way by cleansing agents, the manufacturers of filtering and monitoring equipment should supply recommendations concerning the use of cleansing agents, and these recommendations should be followed in shipboard practice.

1.1.4 Where a range of filtering equipment of the same design, but of different capacities, requires certification in accordance with these specifications, and where the largest capacity in the range does not exceed 50 m^3 per hour, the Administration may accept tests in two capacities within the range, in lieu of tests on every size, providing that the two tests actually performed are from the lowest quarter and highest quarter of the range.

1.1.5 Regulations referred to in these Guidelines and Specifications are those contained in Annex I of MARPOL 73/78.

1.2 Purpose

1.2.1 These Guidelines and Specifications contain requirements regarding the design, installation, performance and testing of pollution prevention equipment required by regulation 16.

1.2.2 The purpose of these Guidelines and Specifications is:

.1 to provide a uniform interpretation of the requirements of regulation 16;

.2 to assist Administrations in determining appropriate design, construction and operational parameters for pollution prevention equipment when such equipment is fitted in ships flying the flag of their States;

.3 to define test and performance requirements for pollution prevention equipment; and

.4 to provide guidance for installation requirements.

1.3 Applicability

1.3.1 These Guidelines and Specifications apply:

.1 to installations fitted to ships, the keel of which are laid or which are at a similar stage of construction on or after 30 April 1994; and

.2 to new installations fitted on or after 30 April 1994 to ships, the keel of which were laid or which were at a similar stage of construction before 30 April 1994 in so far as is reasonable and practicable.

1.3.2 The Guidelines and Specifications adopted under resolution A.393(X) are not applicable to ships to which these new Guidelines and Specifications apply.

1.3.3 Installations fitted to ships the keel of which were laid or which were at a similar stage of construction before 30 April 1994 should comply either with the requirements contained in the Guidelines and Specifications adopted under resolution A.393(X) or with the requirements contained in these Guidelines and Specifications.

1.4 Summary of requirements

1.4.1 The approval requirements for pollution prevention equipment specified in these Guidelines and Specifications are summarized below:

.1 the oil filtering equipment should be tested for type approval in accordance with the procedures described in part 1 of the annex, subject to environmental tests specified part 3 of the annex; and

.2 the oil content meter for the bilge alarms should be tested for type approval in accordance with part 2 of the annex, subject to the environmental tests specified in part 3 of the annex.

2 BACKGROUND

2.1 The requirements of Annex I of MARPOL 73/78 relating to pollution prevention equipment for ships are set out in regulation 16, which stipulates that ships of 400 tons gross tonnage and above should be installed with approved equipment.

2.2 Regulation 16(5) stipulates that the effluent from oil filtering equipment should not exceed 15 ppm. The bilge alarm shall activate to indicate when this level cannot be maintained.

3 DEFINITIONS

3.1 Pollution prevention equipment

3.1.1 For the purpose of these Guidelines and Specifications pollution prevention equipment installed in a ship in compliance with regulation 16 comprises:

.1 oil filtering equipment (15 ppm); and

.2 15 ppm bilge alarms.

3.2 Oil filtering equipment

3.2.1 Oil filtering equipment may include any combination of a separator, filter or coalescer, and also a single unit designed to produce an effluent with oil content not exceeding 15 ppm.

3.3 Bilge alarm

3.3.1 The bilge alarm arrangements specified in regulation 16(5) are referred to in these Guidelines and Specifications as a "bilge alarm".

3.4 ppm

3.4.1 "ppm" means parts of oil per million parts of water by volume.

4 TECHNICAL SPECIFICATIONS

4.1 Oil filtering equipment

4.1.1 The equipment should be strongly constructed and suitable for shipboard use, bearing in mind its intended location on the ship.

4.1.2 It should, 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 equipment should be based in a non-hazardous area, or should be certified by the Administration as safe for use in a hazardous area. Any moving parts which are fitted in hazardous areas should be arranged so as to avoid the formation of static electricity.

4.1.3 The equipment should be so designed that it functions automatically. However, provisions should be made for emergency manual control.

4.1.4 Changing the feed to the oil filtering equipment from oily-water to oil, or from oil and/or water to air should not result in the discharge overboard of any mixture containing more than 15 ppm of oil.

4.1.5 The system should require the minimum of attention to bring it into operation. In the case of equipment used for engine room bilges, there should be no need for any adjustment to valves and other equipment to bring the system into operation, and when fitted in unattended machinery spaces the equipment should be capable of operating for at least 24 hours of normal duty without attention.

4.1.6 All working parts of the equipment which are liable to wear or to damage should be easily accessible for maintenance.

4.2 Oil content meters

4.2.1 These Specifications relate to oil content meters for bilge alarms.

4.2.2 The meters should resist corrosion in conditions of the marine environment.

4.2.3 The meters should, 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 meter should be placed in a non-hazardous area, or should be certified by the Administration as safe for use in a hazardous atmosphere. Any moving parts which are fitted in hazardous areas should be arranged so as to avoid the formation of static electricity.

4.2.4 The meter should not contain or use any substance of a dangerous nature, unless adequate arrangements, acceptable to the Administration, are provided to eliminate any hazards introduced thereby.

4.2.5 It is desirable that the reading should not be affected by the type of oil. If it is, it should not be necessary to calibrate the meter on board ship, but pre-set alterations in the calibration in accordance with instructions drawn up at the time of manufacture are permitted. In the latter case, means should be available to check that the correct calibration has been selected for the oil in question. The accuracy of the readings should at all times remain within the limit specified in paragraph 2.2.1 of part 2 of the annex.

4.2.6 The response time of the meter, that is, the time which elapses between an alteration in the sample being supplied to the meter and the meter showing the correct response, should not exceed 20 seconds.

4.2.7 The meter should be fitted with an alarm device which can be set to operate automatically at any pre-stated value either to alert the crew of the ship or to operate control valves. The meter for the bilge alarm should be fitted with an alarm device which should be pre-set by the manufacturer to activate when the effluent exceeds 15 ppm. These alarms should also operate automatically if at any time the meter should fail to function, require a warm-up period or otherwise be de-energized.

4.2.8 It is recommended that a simple means be provided aboard ship to check on instrument drift, and to confirm the accuracy and repeatability of the instrument reading.

5 SPECIFICATIONS FOR TYPE APPROVAL TESTING OF POLLUTION PREVENTION EQUIPMENT

5.1 Testing requirements

5.1.1 The production model of pollution prevention equipment, for which the approval will apply, should be identical to the equipment, type-tested in accordance with the Test and Performance Specifications contained in part 1 or 2 of the annex to these Guidelines and Specifications. The equipment should also be type-tested in accordance with the specifications for environmental testing contained in part 3 of the annex.

5.2 Approval and certification procedures

5.2.1 Pollution prevention equipment which in every respect fulfil the requirements of these Guidelines and Specifications may be approved by the Administration for fitting on board ships. The approval should take the form of a certificate of type approval specifying the main particulars of the apparatus and any limiting conditions on its usage necessary to ensure its proper performance. Such certificate should be issued in the format shown in part 5 of the annex. A copy of the certificate of type approval for pollution prevention equipment should be carried on board ships fitted with such equipment at all times.

5.2.2 A certificate of type approval for an oil content meter should be issued for the bilge alarm.

5.2.3 Approved pollution prevention equipment may be accepted by other countries for use on their vessels on the basis of the first trials, or after new tests carried out under the supervision of their own representatives. Should equipment pass a test in one country but fail a test of a similar nature in another country, then the two countries concerned should consult one another with a view to reaching a mutually acceptable agreement.

6 INSTALLATION REQUIREMENTS

6.1 Oil filtering equipment

6.1.1 For future inspection purposes on board ship, a sampling point should be provided in a vertical section of the water effluent piping as close as is practicable to the equipment outlet. Recirculating facilities should be provided to enable the oil filtering equipment to be tested with the overboard discharge closed at initial and periodic surveys.

6.1.2 Means should be taken to ensure that, in practice, the rated capacity of the equipment is not exceeded by:

.1 connecting only pumps of a capacity equal to, or less than, that of the equipment; or

.2 permanently restricting the discharge to the equipment where larger pumps may be connected.

6.1.3 In any case, equipment should not be supplied from a pump which has a capacity more than 1.5 times the rated capacity of the equipment.

6.1.4 The equipment should be fitted with a permanently attached plate giving any operational or installation limits considered necessary by the manufacturer or the Administration.

6.2 Oil content meters for bilge alarms

6.2.1 The layout of the shipboard installation should be arranged so that the overall response time between an alteration in the mixture being pumped and the alteration in the meter reading should be as short as possible and in any case not more than 40 seconds, to allow for remedial action being taken before the oil content of the mixture being discharged exceeds the permissible limit.

6.2.2 The arrangement on board ship for the extraction of samples from the discharge line to the meter should give a truly representative sample of the effluent. Sampling points should be arranged in all discharge pipes which have to be monitored for compliance with the Convention.

6.2.3 Where the Convention requires records, the oil content meter should be so designed and constructed that any operation carried out on them is automatically registered by the meter.

ANNEX

The annex provides detailed Test and Performance Specifications for pollution prevention equipment and contains:

Part 1 - Test and Performance Specifications for Type Approval of Oil Filtering Equipment

Part 2 - Test and Performance Specifications for Type Approval of Oil Content Meters for Bilge Alarms

Part 3 - Specifications for Environmental Testing for Type Approval of pollution prevention equipment

Part 4 - Method for the Determination of Oil Content

Part 5 - Documentation of Approval

PART 1 - TEST AND PERFORMANCE SPECIFICATIONS FOR TYPE APPROVAL OF OIL FILTERING EQUIPMENT

1.1 General

1.1.1 These Test and Performance Specifications for Type Approval relate to oil filtering equipment. In addition, the electrical and electronic systems of the equipment should be tested in accordance with the Specifications for Environmental Testing contained in part 3 of this annex.

1.1.2 The equipment being tested should comply with the relevant requirements of the technical specifications contained in section 4.1 of these Guidelines and Specifications.

1.2 Test Specifications

1.2.1 These Specifications relate to oil filtering equipment of low to medium capacity. Oil filtering equipment should be capable of giving an effluent containing not more than 15 ppm of oil irrespective of the oil content (from 0% to 100%) of the feed supplied to it.

1.2.2 The oil/water mixture, with which the system has in practice to deal, depends on:

.1 the position of the oil/water interface, with respect to the suction point, in the space being pumped;

.2 the type of pump used;

.3 the type and degree of closure of any control valve in the circuit; and

.4 the general size and configuration of the system.

It is, therefore, desirable that the test rig be so constructed as to include not only the equipment, but also the pump and the most important of the valves, pipes, etc. (for an example see figures 1a and 1b). The pipework should be designed for a maximum liquid velocity of 3 m/s.

1.2.3 The tests should be carried out with a supply rate equal to the full throughput for which the equipment is designed.

1.2.4 Tests should be performed using two grades of oil. The tests described in 1.2.10 and 1.2.11 should be carried out using either:

.1 a residual fuel oil (test oil A[1/]) of a relative density of not less than 0.94 at 15°C and of a viscosity of not less than 17 centistokes at 100°C (220 centistokes at 37.8°C), and a light distillate fuel oil (test oil B[1/]) having a relative density of not less than 0.83 at 15°C; or

.2 for ships which use residual fuel oil of higher density and viscosity than that referred to above, the test should be carried out with a residual fuel oil (test oil C[1/]) of relative density not less than 0.98 at 15°C and a viscosity of not less than 25 centistokes at 100°C (440 centistokes at 37.8°C), and a light distillate fuel oil (test oil B[1/]) having a relative density of not less than 0.83 at 15°C.

If the equipment 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 should be endorsed under the heading limiting conditions imposed with the following statement:

"The equipment is fitted with heating facilities".

1.2.5 If the filtering equipment includes an integrated feed pump, this equipment should be tested with that pump supplying the required quantity of oil and water to the equipment at its rated capacity. If the equipment is to be fed by the ship's bilge pumps, then the unit will be tested by supplying the required quantity of oil and water mixture to the inlet of a centrifugal pump operating at not less than 1,000 rpm. This pump should have a delivery capacity of not less than 1.5 times the rated capacity of the equipment at the delivery pressure required for the test. The variation in oil/water ratio will be obtained by valves on the oil and water suction pipes adjacent to the pump suction, and the flow rate of oil and water or the oil content of the supply to the equipment should be monitored. If a centrifugal pump is used, the excess pump capacity should be dissipated by either a by-pass to the suction side, or by a throttle valve or standard orifice plate on the discharge side. In all cases, to ensure uniform conditions, the piping arrangements immediately prior to the equipment should be such that the influent to the equipment should 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 oil injection to the equipment should have a length not less than 20 times its diameter. A mixture inlet sampling point and a thermometer pocket should be provided near the equipment inlet and an outlet sampling point and observation window should be provided on the discharge pipe. Figures 1a and 1b give diagrammatic representations of two possible test rigs, though it should be noted that the water and oil from the equipment need not be led back to the supply tanks. Where the water and oil are re-circulated during the test, additional sampling points should be fitted in the water and oil lines to the mixture pump in order to check the quality of the water and oil being supplied to the pump.

1/ The reference is made to appendix for the Certificate of Type Approval for oil filtering equipment.

Figure 1 - Diagrammatic arrangements of test facilities

Typical test rigs:

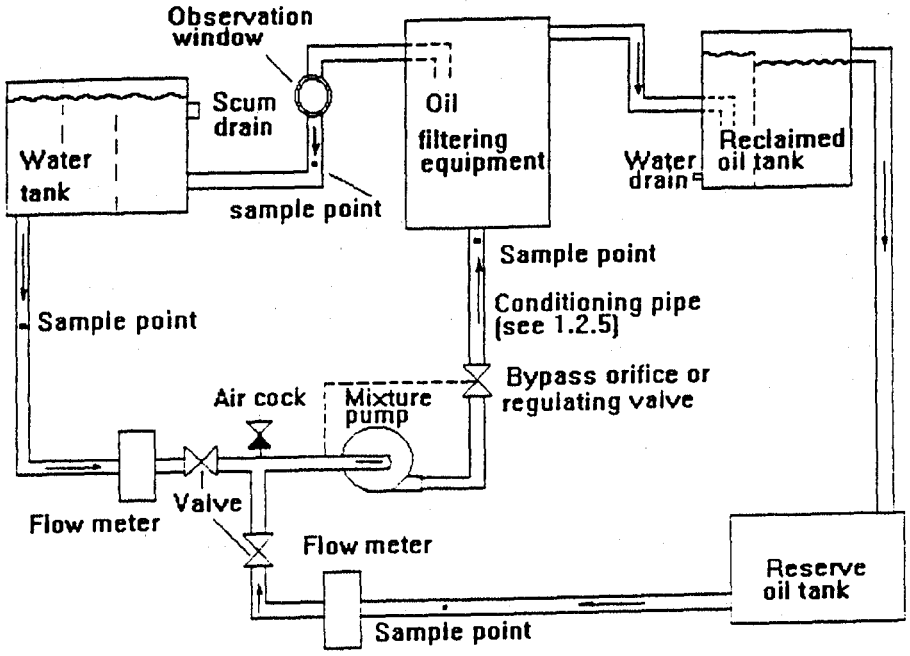


Figure 1a

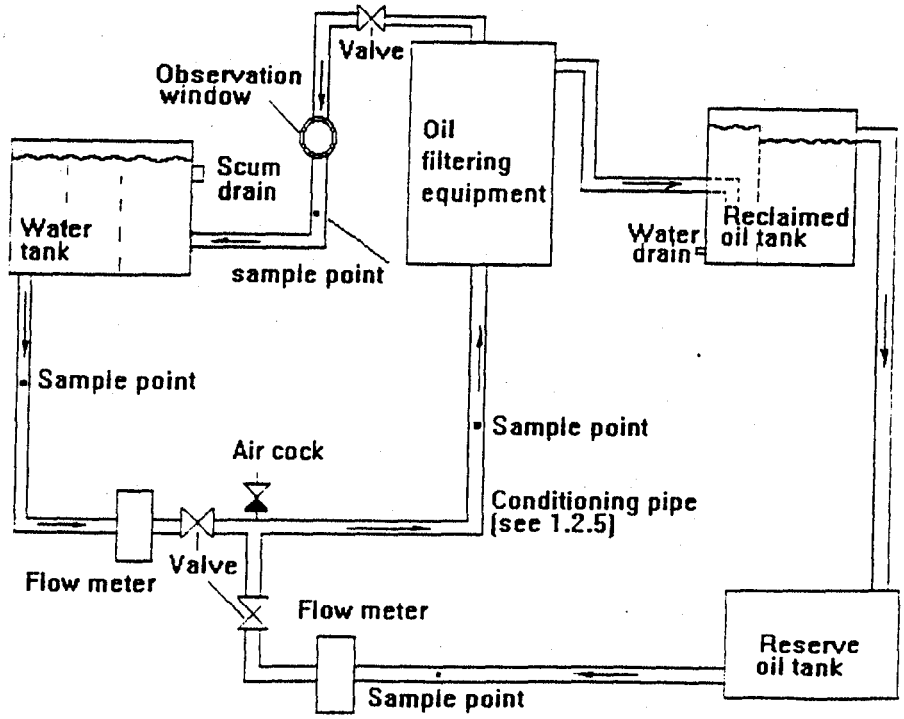
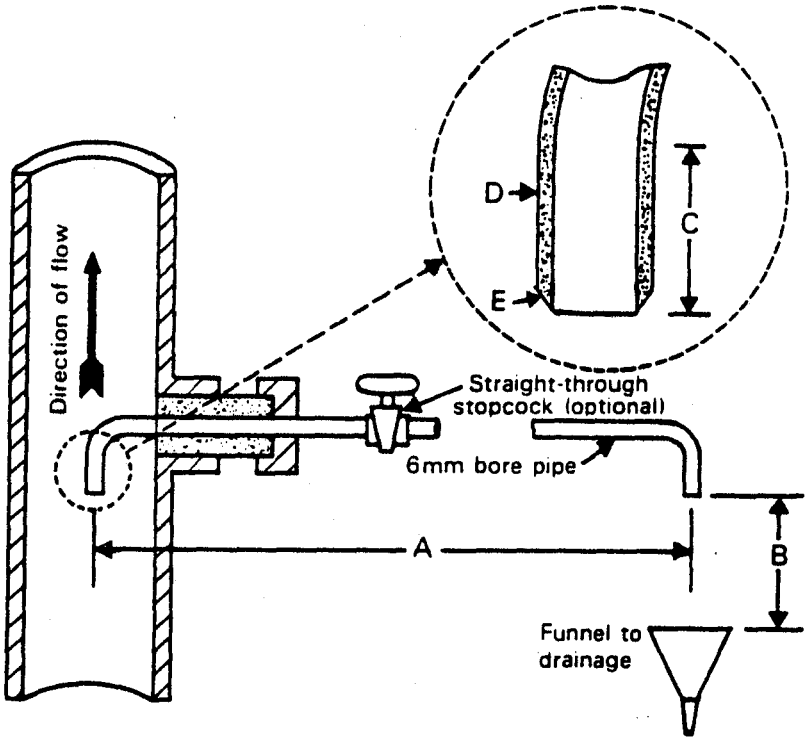


Figure 1b

In order to approach isokinetic sampling, i.e. the sample enters the sampling pipe at stream velocity, the sampling arrangement should be as shown in figure 2 and, if a cock is fitted, free flow should be effected for at least one minute before any sample is taken. The sampling points should be in pipes running vertically.

Figure 2 - Diagram of sampling arrangements



A Distance A, not greater than 400 mm.
B Distance B, sufficient to insert sampling bottle.
C Dimension C, straight length should not be less than 60 mm.
D Dimension D, pipe thickness should not be greater than 2 mm.
E Detail E, chisel-edged chamfer (30°).

1.2.6 The following tests should be carried out:

.1 for residual fuel oils of relative density of not less than 0.94 at 15°C, with water having a relative density of not more than 1.015 at 15°C;

.2 for residual fuel oils of relative density of 0.98 and above at 15°C, with water having a relative density of not more than 1.015 at 15°C.

1.2.7 In the case of equipment depending essentially on gravity, the feed to the system of the test water and oil water mixture should be maintained at a temperature not greater than 40°C, and heating and cooling coils should be provided where necessary. In other forms of separation where the dependence of separation efficiency on temperature is not established, tests should be carried out over a range of influent temperatures representing the normal shipboard operating range of 10°C to 40°C or should be taken at a temperature in this range where the separation efficiency is known to be worst.

1.2.8 In those cases where, for the equipment, it is necessary to heat water up to a given temperature and to supply heat to maintain that temperature, the tests should be carried out at the given temperature.

1.2.9 To ensure that the equipment commences the test with the oil section full of oil and with the supply line impregnated with oil, the equipment should, after filling with water and while in the operating condition, be fed with pure oil for not less than five minutes.

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

1.2.11 A test identical to that described in 1.2.10, including the opening of the air cock, should be carried out with a mixture composed of approximately 25%* oil and 75%* water.

1.2.12 The equipment should be fed with 100%* of oil for at least 5 minutes during which time the observation window should be checked for any oil discharge. Sufficient oil should be fed into the equipment to operate the automatic oil discharge valve. After the operation of the oil discharge valve, the test should be continued for 5 minutes using a 100%* oil supply in order to check the sufficiency of the oil discharge system.

1.2.13 The equipment should be fed with water for 15 minutes. Samples of the separated water effluent are taken at the beginning of the test and after the first 10 minutes.

1.2.14 A test lasting a minimum of 3 hours should be carried out to check that the equipment will operate continuously and automatically. This trial should use a cycle varying progressively from water to oily mixture with approximately 25%* oil content and back to water every 15 minutes, and should test adequately any automatic device which is fitted. The whole test sequence

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* percentage of volume

should be performed as a continuous programme. At the end of the test, while the equipment is being fed with 25%* oil, a water effluent sample should be taken for analysis.

1.2.15 Sampling should be carried out as shown in figure 2 so that the sample taken will suitably represent the fluid issuing from the water outlet of the equipment.

1.2.16 One litre narrow necked glass flasks utilizing caps with Teflon seals or equivalent should be used to collect the samples. Samples should be preserved with the addition of 5 ml of hydrochloric acid (see paragraph 4.3.1 of part 4 of the annex), unless the sample is to be extracted on the same day of collection, and be sealed and labelled in the presence of a representative of the national authority and arrangements should be made for anlaysis as soon as possible and in any case within seven days provided the samples are being kept between 2°C and 6°C at laboratories approved by the Administration.

1.2.17 The oil content of the samples should be determined in accordance with part 4 of the annex.

1.2.18 When accurate and reliable oil content meters are fitted at inlet and outlet of the equipment, 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.

1.2.19 In the presentation of the results, the following data should be reported, using the International Metric System of Units:

.1 properties of the oil:

- relative density at 15°C
- viscosity (centistokes at 100°C/37.8°C)
- flashpoint
- ash
- water content (total);

.2 properties of the water:

- relative density at 15°C with details of any solid matter present;

.3 temperature at the inlet to the equipment;

.4 the method used in analysis of all samples taken and the results thereof together with meter readings where appropriate;

.5 a diagram of the test rig; and

.6 a diagram of the sampling arrangements.

1.2.20 The recommendations of the manufacturer of the filtering equipment concerning the choice and application of cleansing agents used for cleaning

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* percentage of volume

purposes in machinery spaces should be recorded in the appendix to the certificate of type approval. If the manufacturer declares that the user is free in the choice and application of cleansing agents because this does not affect the performance of the equipment, then this is to be recorded also. The manufacturer should include this information in the instruction manual for the filtering equipment.

PART 2 - TEST AND PERFORMANCE SPECIFICATIONS FOR TYPE APPROVAL OF OIL CONTENT METERS FOR BILGE ALARMS

2.1 General

2.1.1 These Test and Performance Specifications relate to oil content meters for bilge alarms. In addition, the electrical and electronic section of these systems should be tested in accordance with the Specifications for Environmental Testing contained in part 3 of this annex.

2.1.2 The meter being tested should comply with all the relevant requirements of the technical Specifications contained in section 4.2 of these Guidelines and Specifications.

2.2 Test specifications

2.2.1 For a meter designed for a bilge alarm, the accuracy should be within ± 5 ppm. The accuracy of bilge alarms should remain within the above limits despite the presence of contaminants other than oil, and the power supply varying by 10% from the design value, i.e. in respect of electricity, compressed air, etc.

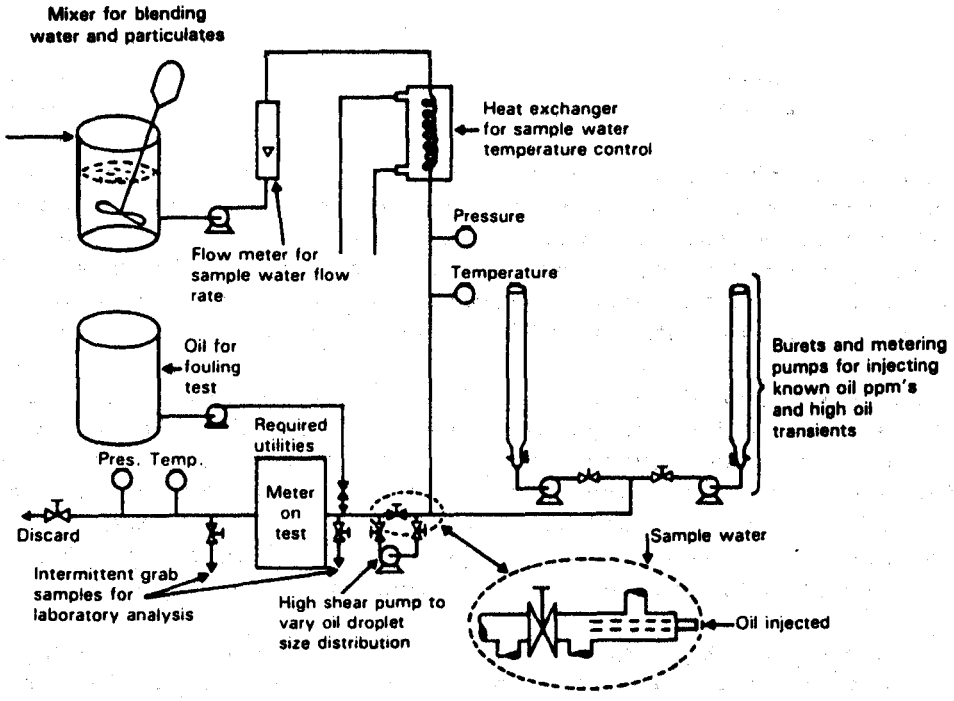
2.2.2 The sampling arrangement should be such that a representative homogeneous sample is obtained under all conditions of operation and under all operational proportions of oil content. The sample should be obtained from the full flow through the meter, but when this is impracticable the sampling arrangements shown in figure 2 in part 1 should be used. Special care should be given to this stage of the process and the validity of the resultant findings.

2.2.3 During the various tests the response time of the meter should be checked and it should also be noted whether alarms operate adequately when a pre-stated threshold is exceeded.

2.2.4 A diagrammatic arrangement of a test facility for evaluating the performance of oil content meters is given in figure 3. The accuracy of the oil content meter will be determined by comparing its readings against a known flow of oil injected into a known flow of water. The grab samples taken will be analysed in a laboratory by the methods specified in part 4 of this annex. The results of the laboratory analysis will be used for correction and to indicate sampling and test equipment variability. The water flow rate will be adjusted so that the entire oil-water flow passes through the oil content meter, except the intermittent grab sample stream. Special care should be given to keep, continuously, a constant oil content in the water that flows into the meter. The oil and contaminant metering pumps should be adjusted to deliver a nearly continuous quantity of oil. If oil injection becomes

intermittent at low concentrations, the oil may be premixed with water to provide continuous flow if absolutely necessary. The oil injection point should be immediately up-stream of the oil content meter inlet to minimize time lags.

Figure 3 - Diagrammatic arrangements of test facilities



2.2.5 The oil content meter will be calibrated and zeroed as per the manufacturer's instructions. It will then be tested with light distillate fuel oil of a relative density of not less than 0.83 at 15°C at the following concentrations in ppm: 0, 15, and at the full scale of the meter. Each concentration test will last for 15 minutes. Following each concentration test, the meter will be run on oil-free water for 15 minutes and the reading noted. If it proves necessary to re-zero or re-calibrate the meter during this test, this fact will be noted.

2.2.6 The oil content meter for the bilge alarms should undergo contaminant tests as follows:

the oil content meter for the bilge alarms should be run on a 10 ppm light distillate fuel oil sample, and each of the three contaminants listed below will be added to the water tank in the concentrations given. Any shift in the meter reading should be noted and recorded on the Certificate.

- Fresh water (if seawater is used for the test programme)

- Very salt water - 6% common salt with tap water.

- Non-soluble suspended solids - about 10 ppm air cleaner test dust to the following specifications:

Particle size in micrometers	Percentage of total weight
0- 5	39±2
5-10	18±3
10-20	16±3
20-40	18±3
40-80	9±3

2.2.7 The meter should be run on a 15 ppm light distillate fuel oil sample. The water pressure or flow rate of the mixture should be adjusted from one-half normal, normal and twice normal. Any effect of these changes on the meter reading should be noted and recorded on the Certificate. This test may require modification for meters with flow or pressure regulators or meters designed to discharge into an ambient pressure sump.

2.2.8 The meter should be run on a 15 ppm light distillate fuel oil sample. The water and oil injection pumps should be shut off. The meter will be left turned on with no other changes made. After eight hours, the water and oil injection pump should be turned on and set to provide the mixture of 15 ppm. The meter readings before and after each test and any damage to the meter should be noted and recorded on the Certificate. This test determines also the proper functioning of the low flow shut-off and alarm.

2.2.9 If the meter requires any utilities besides electricity, it should be tested with these utilities at 110% and 90% of the design figures.

2.2.10 The meter should be calibrated and zeroed. A 15 ppm light distillate fuel oil sample will run through the meter for eight hours and any calibration drift noted. Following this, the meter should be run on oil-free water and any zero drift noted and recorded on the Certificate.

2.2.11 The response time is to be taken for the meter to give an alarm at 15 ppm oil concentration after the supply to the meter is changed from clean water to oily water, having more than 15 ppm oil. The colour of the water supplied to the meter is not to affect the operation of the instrument. The meter is to be tested for colour using 2.5 ppm black ink. The meter is to show no deviation when tested for colour using 2.5 ppm black ink.

2.2.12 A specification of the instrument concerned and a diagrammatic presentation of the test arrangements should be provided and the following data should be reported, using the International Metric System of Units:

.1 types and properties of oils used in the tests;

.2 details of contaminants used, in the form, for example, of a supplier's certificate or laboratory test protocol; and

.3 results of tests and analysis of grab samples.

2.2.13 The recommendations of the manufacturer of the oil content meter concerning the choice and application of cleansing agents used for cleaning purposes in machinery spaces should be recorded in the appendix to the certificate of type approval. If the manufacturer declares that the user is free in the choice and application of cleansing agents because this not affect the performance of the equipment, then this is to be recorded also. The manufacturer should include this information in the instruction manual of the oil content meter.

PART 3 - SPECIFICATIONS FOR ENVIRONMENTAL TESTING FOR TYPE APPROVAL OF POLLUTION PREVENTION EQUIPMENT

3.1 General

3.1.1 The specifications for environmental testing for type approval relate to the electrical and electronic sections of:

.1 oil filtering equipment; and

.2 bilge alarms.

The equipment tested should comply with all the relevant requirements contained in section 5 of these Guidelines and Specifications.

3.2 Test specifications

3.2.1 Testing requirements

3.2.1.1 The electrical and electronic sections of the pollution control equipment in the standard production configuration should be subjected to the programme of environmental tests set out in this Specification at a laboratory approved for the purpose by the Administration or by the competent authority of the manufacturer's home country. A copy of the environmental test document, in a format similar to that specified in section 2 of part 5 of this annex, should be submitted to the Administration by the manufacturer, together with the application for type approval.

3.2.2 Test specification details

3.2.2.1 Equipment should operate satisfactorily on completion of each of the following environmental tests:

.1 Vibration tests

.1.1 a search should be made for resonance over the following range of frequency and amplitude of acceleration:

.1.1.1 2 to 13.2 Hz with an amplitude of ± 1 mm; and

.1.1.2 13.2 to 80 Hz with an acceleration of ± 0.7 g.

This search should be made in each of the three planes at a rate sufficiently low to permit detection of resonance;

.1.2 the equipment should be vibrated in the planes at each major resonant frequency for a period of two hours;

.1.3 if there is no resonant frequency, the equipment should be vibrated in each of the planes at 30 Hz with an acceleration of ± 0.7 g for a period of two hours;

.1.4 after completion of the tests specified in .1.2 or .1.3 of this paragraph a search should again be made for resonance and there should be no significant change in the vibration pattern.

.2 Temperature tests

.2.1 equipment that may be installed in an enclosed space that is environmentally controlled, including an engine room, should be subjected, for a period of not less than two hours, to:

.2.1.1 a low temperature test at 0°C; and

.2.1.2 a high temperature test at 55°C.

At the end of each of the tests referred to, the equipment should be switched on and it should function normally under the test conditions.

.3 Humidity tests

.3.1 equipment should be left switched off for a period of two hours at a temperature of 55°C in an atmosphere with a relative humidity of 90%. At the end of this period the equipment should be switched on and should operate satisfactorily for one hour.

.4 Inclination test

.4.1 equipment should operate satisfactorily at angles of inclination up to 22.5° in any plane from the normal operating position.

.5 Reliability of electrical and electronic equipment

.5.1 the electrical and electronic components of the equipment should be of a quality guaranteed by the manufacturer and suitable for their intended purpose.

PART 4 - METHOD FOR DETERMINATION OF OIL CONTENT

4.1 Scope and application

4.1.1 The method includes the measurement of most light oil fractions, although some loss of volatile components will occur during the extractions.

4.1.2 The method has a nominal working range from 2 to 80 mg/l. The lower level of detection can be improved to 0.1 mg/l by using longer path-length cells. The upper limit of the method can be extended at least to 1,000 mg/l by preparing dilutions of the sample extract.

4.2 Summary of method

The sample is acidified to a low pH and extracted with two volumes of carbon tetrachloride. The oil content is determined by comparison of the infrared absorbances of the sample extract against known concentrations of the appropriate reference oil. Other suitable non-infrared active solvents may be used if perferred.

4.3 Sample and storage

4.3.1 A representative sample of 1 litre volume is colleced in a narrow-neck glass bottle with a pressure-sealing cap. Unless the sample will be extracted on the day of collection, it is preserved with the addition of 5 ml hydrochloric acid (HCl) (4.5.1).

4.3.2 Because losses of oily matter will occur on sampling equipment, the collection of a composite sample is impractical. Individual portions collected at prescribed time intervals must be analysed separately to obtain the average concentration over an extended period.

4.4 Apparatus

4.4.1 Separatory funnel, 1,000 ml volume, with Teflon stopcock.

4.4.2 Infrared spectrophotometer.

4.4.3 Cells, 5 mm path-length, sodium chloride or infrared-grade quartz with a minimum of 80% transmittance at 2,930 cm^{-1}. The 5 mm path-length is recommended as being convenient for monitoring levels normally encountered. Longer path-lengths may be used.

4.4.4 Filter paper, medium grade, 12.5 cm.

4.5 Reagents

4.5.1 Hydrochloric acid, HCl 1:1. Mix equal amounts of concentrated HCl and distilled water.

4.5.2 Sodium chloride, NaCl reagent grade.

4.5.3 Carbon tetrachloride, CCl_4 reagent grade.

4.5.4 Oil reference: Oil collected from the source at the same time the sample was collected.

4.5.5 Stock reference standard (3 mg/ml): accurately weigh about 0.30g of reference oil (4.5.4) into a tared 100 ml volumetric flask and dilute to volume with carbon tetrachloride. Using the reference oil at room ambient temperature, record the relative density and temperature of the reference oil. A weight-to-volume conversion to volume-to-volume must take into account the differing densities of the two liquids used in preparing the calibration plot (4.8.2).

4.5.6 Calibration standards: prepare a series of dilutions by pipetting volumes of stock reference standards into 100 ml volumetric flasks and

diluting to volume with carbon tetrachloride. A convenient series of volumes is 5, 10, 15, 20, and 25 ml of stock solution. Calculate the exact concentrations of the dilution in millilitres times ten to the minus three per hundred millilitres of solvent (ml x 10^{-3}/100 ml) from the information above (4.5.5).

4.6 Extraction

4.6.1 If the sample was not acidified at time of collection, add 5 ml hydrochloric acid (4.5.1) to the sample bottle. After mixing the sample, check the pH by touching pH-sensitive paper to the cap to ensure that the pH is 2 or lower. Add more acid if necessary.

4.6.2 Pour the sample into a separatory funnel and add 5 g of sodium chloride.

4.6.3 Add 50 ml carbon tetrachloride to the sample bottle. Cap tightly and thoroughly shake the bottle to rinse the inside and cap. Transfer the solvent into the separatory funnel and extract by shaking vigorously for two minutes. Allow the layers to separate.

4.6.4 Drain the solvent layer through a funnel containing solvent-moistened filter paper into a 100 ml volumetric flask.

4.6.5 Repeat steps 4.6.3 and 4.6.4 with an additional 50 ml portion of fresh solvent; combine all solvent in the volumetric flask.

4.6.6 Rinse the top of the separatory funnel, filter paper and funnel with small portions of carbon tetrachloride and collect the rinsings in the volumetric flask. Adjust the extract volume up to 100 ml and stopper the flask. **Mix well.**

4.6.7 Drain the water layer into a 1,000 ml graduated cylinder and estimate the sample volume to the nearest 5 ml.

4.7 Infrared Spectroscopy

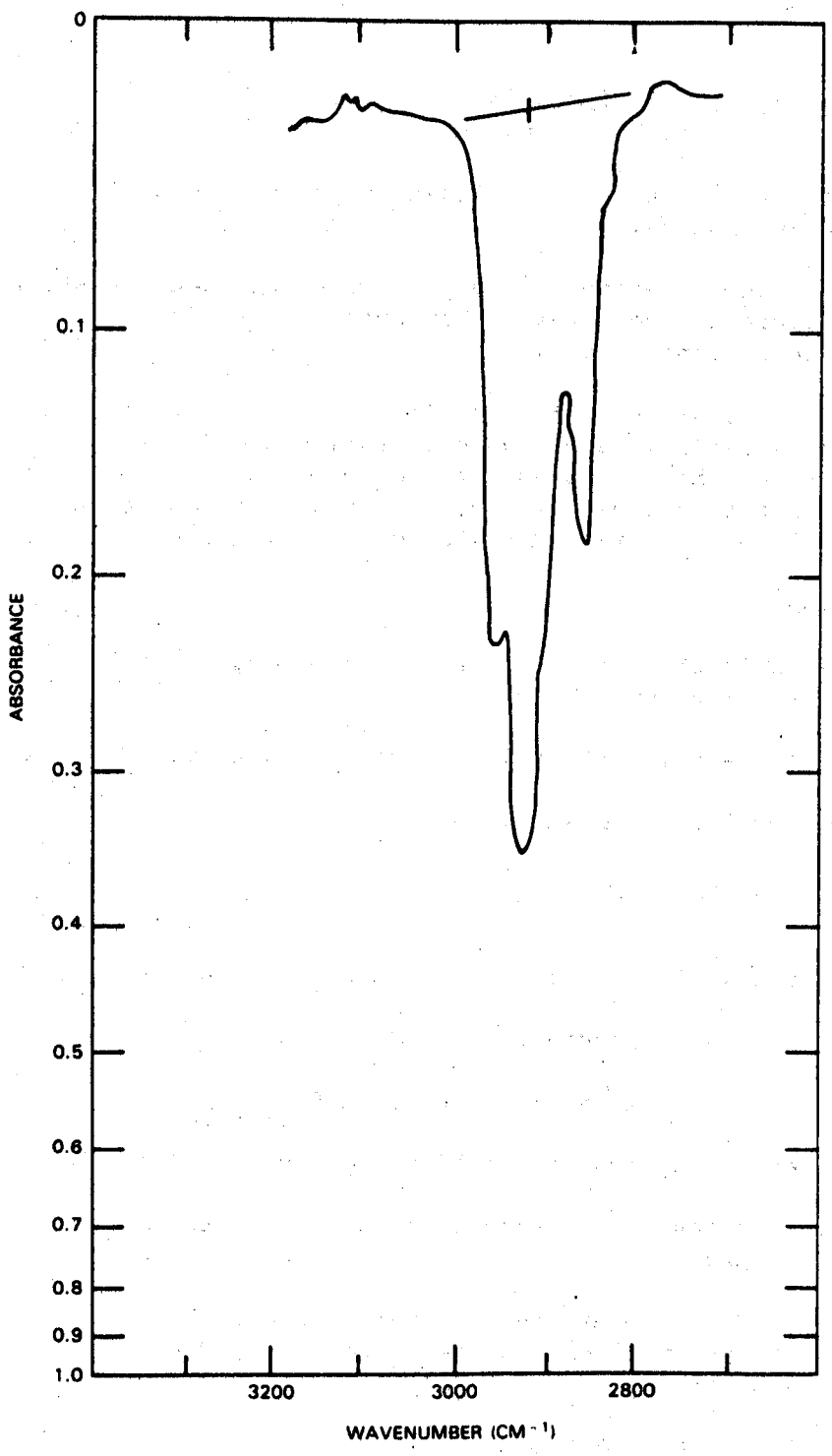
4.7.1 Prepare the infrared spectrophotometer according to manufacturer's instructions.

4.7.2 Rinse a cell with two volumes of solution to be measured, then completely fill the cell with solution. Place a matched cell containing carbon tetrachloride in the reference beam.

4.7.3 Scan samples and standards from 3,000 cm^{-1} to 2,700 cm^{-1}.

NOTE 1: Single beam and non-scaning spectrophotometers can be used for this test. Follow the manufacturer's instructions and measure the absorbance directly at or near 2,930 cm^{-1}.

Figure 4 - Spectrum illustrating baseline construction



4.7.4 Construct a straight baseline under the hydrocarbon band as illustrated in figure 4. If the scan is recorded on abosorbance paper, read the absorbance of the peak maximum at 2,930 cm^{-1} and subtract the absorbance of the baseline at that point. If the scan is recorded on transmittance paper, the net absorbance is:

$$\log_{10} \frac{\%T \text{ (baseline)}}{\%T \text{ (peak maximum)}}$$

4.7.5 Prepare a calibration plot of net absorbance vs mg/100 ml oil using the response of the standards.

NOTE 2: The oil concentration may be plotted as per cent of stock standard. When this procedure is used, the concentration of the stock standard must be used in the calculations (4.8.2).

4.7.6 If the net absorbance of a sample exceeds 0.8 or the linear range of the instrument as determined by the calibration plot, prepare a dilution of the sample by pipetting an appropriate volume of the extract into a volumetric flask and diluting to volume. If the absorbance is less than 0.1, more accurate results can be obtained by using a longer path-length cell.

4.8 Calculations

4.8.1 Use the calibration plot to calculate the mg of oil in each 100 ml of sample extract or dilution.

4.8.2 Calculate the oil content in the sample using the formula:

$$\text{mg/l oil} = \frac{R \times D \times 1000}{V}$$

where:

R = mg of oil in 100 ml solution (determined from calibration plot)

D = extract dilution factor, if used (4.7.6)

V = volume of sample, in millilitres (4.6.7)

4.8.3 Report results to two significant figures for levels below 100 mg/l.

NOTE 3: For quality control, a reagent blank should be carried through each step of the procedure.

4.8.4 For purposes of comparison to meter records, the results should also be presented in parts per million (volume/volume) with due allowance for the relative density of the oil.

PART 5 - DOCUMENTATION OF APPROVAL

5.1 Certificate of Type Approval for pollution prevention equipment

5.1.1 Satisfactory compliance with all the test requirements enumerated in parts 1 and 2 of this annex should be shown in the Certificate of Type Approval issued by the Administration in the format specified in paragraph 5.1.2 below. An Administration may issue a Certificate of Type Approval based on separate testing or on testing already carried out under supervision by another Administration.

5.1.2 A Certificate of Type Approval should be in the format shown in appendix 1 or 2 to this annex. The Certificate should identify the type and model of the pollution prevention equipment to which it applies and identify equipment assembly drawings, duly dated. Each drawing should bear the model specification numbers or equivalent identification details. The Certificate should include the full performance test protocol on which it is based. If a Certificate of Type Approval is issued by an Administration based on a Certificate previously issued by another Administration, the Certificate should identify the Administration which conducted the tests on the pollution prevention equipment and a copy of the original test results should be attached to it.

5.2 Format of environmental test protocol

5.2.1 Satisfactory compliance with the environmental tests laid down in these Guidelines and Specifications, where applicable, should be shown on the environmental test protocol issued by the testing laboratory. The protocol should include at least the following details:

.1 identification of the equipment by type and drawing number, duly dated; and

.2 a statement of the tests conducted on the equipment, including the results thereof.

5.2.2 The environmental test protocol should be endorsed by either the Administration or a competent authority of the manufacturer's home country to confirm that the laboratory is approved to conduct such tests. The protocol should also be signed and dated by the person in charge of the laboratory.

APPENDIX 1

BADGE
OR
CIPHER

NAME OF ADMINISTRATION

CERTIFICATE OF TYPE APPROVAL FOR OIL FILTERING EQUIPMENT
(15 ppm equipment)

This is to certify that the equipment listed below has been examined and tested in accordance with the requirements of the Specifications contained in part 1 of the annex to the Guidelines and Specifications contained in IMO resolution MEPC ...(33). This Certificate is valid only for equipment referred to below.

Equipment supplied by .....

under type and model designation .....
and incorporating:

*Equipment manufactured by .....

to specification/assembly drawing No. ..... date .....

*Coalescer manufactured by .....

to specification/assembly drawing No. .....

*Filters manufactured by .....

to specification/assembly drawing No. .....

Control equipment manufactured by .....

to specification/assembly drawing No. .....

Maximum throughput of system .....m^3/h .....

The equipment has been tested with residual oil having a relative density of not less than 0.94* or 0.98* at 15°C.

If integral feed pump is not fitted state method proposed for ensuring maximum throughput of system is not exceeded.

A copy of this Certificate should be carried aboard a vessel fitted with this equipment at all times.

Limiting Conditions imposed

Test data and results attached in the appendix

Official stamp

Signed .....
Administration of .....
Dated this ..... day of ..... 19..

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* Delete as appropriate

APPENDIX

TEST DATA AND RESULTS OF TESTS CONDUCTED ON A FILTERING EQUIPMENT IN ACCORDANCE WITH PART 1 OF THE ANNEX TO THE GUIDELINES AND SPECIFICATIONS CONTAINED IN IMO RESOLUTION MEPC...(33)

Equipment submitted by .....

Test location .....

Method of sample analysis .....

Samples analysed by .....

Environmental testing of the electrical and electronic sections of the equipment has been carried out in accordance with part 3 of the annex to the Guidelines and Specifications contained in IMO resolution MEPC...(33). The equipment functioned satisfactorily on completion of each test specified on the environmental test protocol.

Manufacturers' recommendations and information concerning the use of cleansing agents .....

Test oil (A)/(C)*		
	Relative density	at 15°C
	Viscosity	Centistokes at 100°C
		Centistokes at 37.8°C
	Flashpoint	°C
	Ash content	%
	Water content at start of test	%
Test oil (B)		
	Relative density	at 15°C
	Viscosity	Centistokes at 100°C
		Centistokes at 37.8°C
	Flashpoint	°C
	Ash content	%
	Water content at start of test	%
Test water		
	Relative density	at 15°C
	Solid matter present	
Test temperatures		
	Ambient	°C
	Test oil (A)(C)*	°C
	Test oil (B)	°C
	Test water	°C

Diagram of test rig attached

Diagram of sampling arrangement attached

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* Delete as appropriate.

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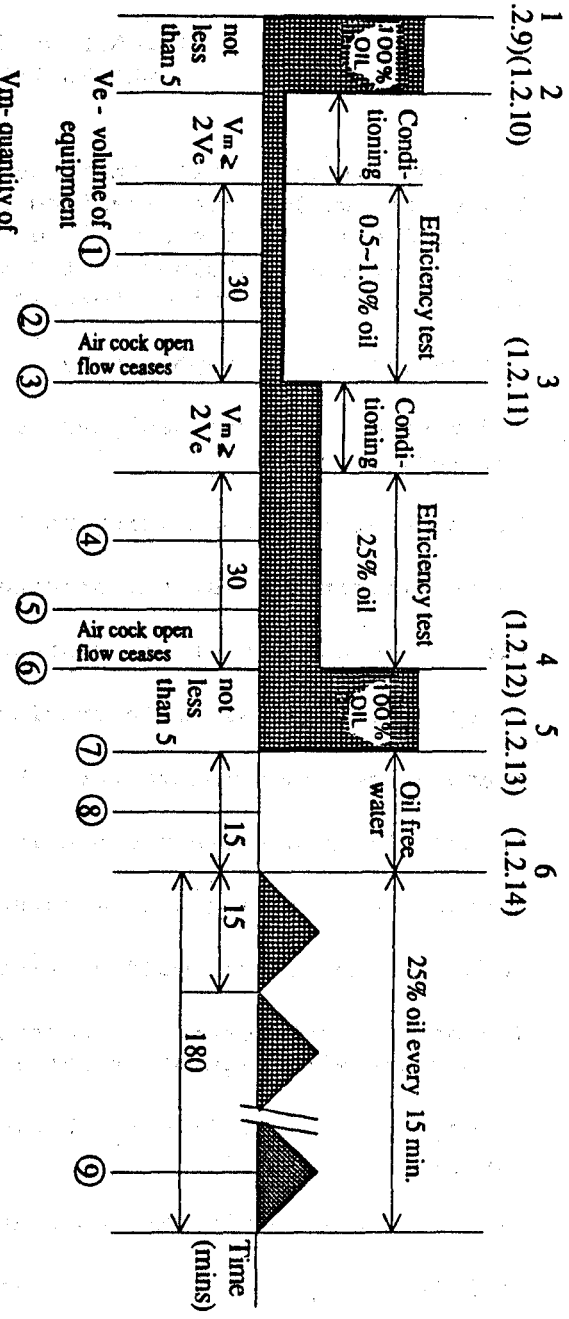
TEST RESULTS (IN PPM) AND TEST PROCEDURES

Test on (A)/(C)*		Test on (B)	
Influent	Effluent	Influent	Effluent



1-6 steps refer to paragraphs 1.2.9 - 1.2.14

① - ⑨ points where samples to be taken

Test sample ⑨.....

(taken at the end of final oil phase auto test, paragraph 1.2.14 - Part 1 of the Annex to resolution MEPC.60(33))

Signed ..... Date ..... Official stamp

(Official stamp or equivalent identification and the date of approval to be placed on all pages of the test protocol.)

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* Delete as appropriate

APPENDIX 2

BADGE
OR
CIPHER

NAME OF ADMINISTRATION

CERTIFICATE OF TYPE APPROVAL FOR OIL CONTENT METERS INTENDED FOR BILGE ALARMS
(15 ppm alarm)

This is to certify that the oil content meter, comprising the equipment listed below, has been examined and tested in accordance with the requirements of the Specifications contained in part 2 of the annex to the Guidelines and Specifications contained in IMO resolution MEPC...(33). This Certificate is valid only for an oil content meter referred to below.

Oil content meter supplied by .....

under type and model designation .....
and incorporating:

Oil content meter analysing unit manufactured by .....

to specification/assembly drawing No. .....date .....

Electronic section of oil content meter manufactured by .....

to specification/assembly drawing No. .....date .....

*Sample feed pump manufactured by .....

to specification/assembly drawing No. .....date .....

*Sample conditioning unit manufactured by .....

to specification/assembly drawing No. .....date .....

The oil content meter is acceptable for use with a 15 ppm bilge alarm in accordance with regulation 16(5).

A copy of this Certificate should be carried aboard a vessel fitted with this equipment at all times.

Test data and results attached as appendix.

Official stamp

Signed .....
Administration of .....
Dated this ..... day of ..... 19..

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* Delete as appropriate.

APPENDIX

TEST DATA AND RESULTS OF TESTS CONDUCTED ON AN OIL CONTENT METER IN ACCORDANCE WITH PART 2 OF THE ANNEX TO THE GUIDELINES AND SPECIFICATIONS CONTAINED IN IMO RESOLUTION MEPC...(33)

Oil content meter submitted by .....

Test location .....

Method of sample analysis .....

Samples analysed by .....

Environmental testing of the electronic section of the oil content meter has been carried out in accordance with part 3 of the annex to the Guidelines and Specifications contained in IMO resolution MEPC...(33). The equipment functioned satisfactorily on completion of each test specified on the environmental test protocol.

Manufacturers' recommendations and information concerning the use of cleansing agents .....

		READINGS (ppm)			
		Indicated	Measured	Grab sample	REMARKS
CALIBRATION	0	.....	.....	.....	
LIGHT DISTILLATE FUEL OIL	15	.....	.....	.....	
		.....	.....	.....	
		.....	.....	.....	
FULL SCALE		.....	.....	.....	TEST
					WATER TEMPERATURE
		.....	.....	.....	RE-ZERO YES/NO
					RECALIBRATE YES/NO

RESPONSE TIMES 15 ppm ... seconds

CONTAMINANTS TEST

1 Non-oil particulate matter

Meter reading shift with ppm non-oil particulate contaminants mixed with water and light distillate oil added in oil concentrations of:

- ppm ... ppm
- ppm ... ppm
- ppm ... ppm

COLOUR TEST
2.5 ppm black ink test pass/fail*

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* Delete as appropriate

SAMPLE PRESSURE OR FLOW TEST

Meter reading shift at 50% of normal ... ppm

Meter reading shift at 200% of normal ... ppm

Deviations from this test should be stated if necessary

Meter reading before shut-off ... ppm

Meter reading after start-up (minimum dry period 8 hours) ... ppm

Damage to meter as follows:

.....

.....

.....

.....

UTILITIES SUPPLY VARIATION TEST

110% voltage effects .....

90% voltage effects .....

110% air pressure effects .....

90% air pressure effects .....

110% hydraulic pressure effects .....

90% hydraulic pressure effects .....

OTHER COMMENTS

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.....

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CALIBRATION AND ZERO TEST

Calibration drift ... ppm

Zero drift ... ppm

Signed Date Offical stamp

(Official stamp or equivalent identification and the date of approval to be placed on all pages of the test protocol)

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