



CERTIFICATE OF TYPE APPROVAL

This is to certify that

Lloyd's Register did undertake the relevant type approval procedures of the equipment detailed below which was found to be in compliance with the essential Pollution Prevention requirements for use on ships and offshore installations classed with Lloyd's Register, and for use on ships and offshore installations when authorised by contracting governments to issue the relevant certificates, licences, permits, etc.

Manufacturer Holland Marine Services Amsterdam B.V.

Address Vlothavenweg 16
1013BJ Amsterdam
The Netherlands

Type SEWAGE TREATMENT PLANTS (POLLUTION PREVENTION)

Product Description MSD-III Series Advanced Waste Water Treatment unit, Consisting:
MSD-III/10, MSD-III/20, MSD-III/30, MSD-III/40, MSD-III/50, MSD-III/60,
MSD-III/70, MSD-III/80, MSD-III/100, MSD-III/120, MSD-III/140, MSD-III/160, MSD-
III/200, MSD-III/240, MSD-III/280, MSD-III/320, MSD-III/400
MSD-III-VAC/10, MSD-III-VAC/20, MSD-III-VAC/30, MSD-III-VAC/40,
MSD-III-VAC/50, MSD-III-VAC/60, MSD-III-VAC/70, MSD-III-VAC/80,
MSD-III-VAC/100, MSD-III-VAC/120, MSD-III-VAC/140, MSD-III-VAC/160, MSD-III-
VAC/200, MSD-III-VAC/240, MSD-III-VAC/280, MSD-III-VAC/320, MSD-III-VAC/400

Specified Standard MEPC.227 (64), excluding para 4.2

The attached Design Appraisal Document forms part of this certificate.

This certificate remains valid unless cancelled or revoked, provided the conditions in the attached Design Appraisal Document are complied with and the equipment remains satisfactory in service.

Date of issue 23 December 2015

Expiry date 22 December 2020

Certificate No. SAS P150071

Signed

Sheet No 1 of 9

Name

J. D. Morley
Surveyor to Lloyd's Register EMEA
A Member of the Lloyd's Register Group

Note:

This certificate is not valid for equipment, the design or manufacture of which has been varied or modified from the specimen tested. The manufacturer should notify Lloyd's Register of any modification or changes to the equipment in order to obtain a valid Certificate.

Lloyd's Register Group Limited, its affiliates and subsidiaries and their respective officers, employees or agents are, individually and collectively, referred to in this clause as the 'Lloyd's Register'. Lloyd's Register assumes no responsibility and shall not be liable to any person for any loss, damage or expense caused by reliance on the information or advice in this document or howsoever provided, unless that person has signed a contract with the relevant Lloyd's Register entity for the provision of this information or advice and in that case any responsibility or liability is exclusively on the terms and conditions set out in that contract.



Page	2 of 9
Document number	SAS P150071
Issue number	1

DESIGN APPRAISAL DOCUMENT

Date 23 December 2015	Quote this reference on all future communications MTES/MARPOL/TA/JDM/WP21497274
--------------------------	--

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS P150071

This Design Appraisal Document forms part of the Certificate.

APPROVAL DOCUMENTATION

This equipment has been examined and satisfactory tested in accordance with the International Maritime Organisation Resolution MEPC.227 (64) to meet the operational requirements referred to in regulations 9.1.1 of MARPOL Annex IV of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the 1978 and 1997 Protocols (as amended by resolutions MEPC. 115(51) and MEPC. 200(62)).

Two equipments (MSD-III/20 and MSD-III/100) were tested and produced an effluent which, on analysis, did not exceed:

This acceptance is based upon the examination of drawings and satisfactory test carried out under the supervision of Lloyd's Register EMEA on below treatment plants.

The tests on the sewage treatment plant were carried out ashore at the municipal sewage treatment equipment in Sneek in The Netherlands and completed on 16th July 2010 and 19th November 2010. The control and sensor equipment were tested in Hengelo in The Netherlands for shock and vibration on 28th September 2011 .

	MSD-III/20	MSD-III/100
Designed hydraulic loading:	1.65 cubic metres per day	8.25 cubic metres per day
Designed organic loading:	0.92 kilograms per day (BOD)	4.68 kilograms per day (BOD)

The sewage treatment plant was tested and produced an effluent which, on analysis, produces:

- i) a geometric mean of no more than 100 thermotolerant faecal coliform per 100 millilitre;
- ii) a geometric mean of total Suspended Solids of no more than 35 Qi/Qe milligrams per litre;
- iii) a geometric mean of the 5-day Biochemical Oxygen Demand without nitrification (BOD5 without nitrification) of no more than 25 Qi/Qe mg/l;
- iv) a geometric mean of Chemical Oxygen Demand (COD) of no more than 125 Qi/Qe mg/l;
- v) pH between 6 and 8.5;

Confirm that the sewage treatment plant can operate at angles of inclination of 22.5° in any plane from the normal operating position.



Page 3 of 9
Document number SAS P150071
Issue number 1

DESIGN APPRAISAL DOCUMENT

Date 23 December 2015	Quote this reference on all future communications MTES/MARPOL/TA/JDM/WP21497274
--------------------------	--

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS P150071

TEST RESULTS

Test results and details of tests conducted on two of Sewage Treatment Equipment in accordance with IMO Resolution MEPC.159 (55), and now upgraded to MEPC 227(64).

Sewage Treatment Equipment, Type	MSD-III/20	MSD-III/100
Manufactured by	Holland Marine Services Amsterdam BV	Holland Marine Services Amsterdam BV
Organisation conducting the test	<ul style="list-style-type: none"> Lettinga Associates Foundation Thales Group 	<ul style="list-style-type: none"> Lettinga Associates Foundation Thales Group
Test Location	<ul style="list-style-type: none"> Sneek, The Netherlands Hengelo, The Netherlands 	<ul style="list-style-type: none"> Sneek, The Netherlands Hengelo, The Netherlands
Designed hydraulic loading	1.65 cubic metres per day	8.25 cubic metres per day
Designed organic loading	0.92 kilograms per day BOD	4.68 kilograms per day BOD
Number of effluent samples tested	40 + 40	40 + 40
Number of influent samples tested	50 + 20	50 + 20
Total suspended solids influent quality	>500 milligrams per litre	>500 milligrams per litre
Total nitrogen influent quality	Not Applicable mg/l as nitrogen	Not Applicable mg/l as nitrogen
Total phosphorus influent quality	Not Applicable mg/L as phosphorus	Not Applicable mg/L as phosphorus
Maximum hydraulic loading	4.8 cubic metres per day	24.0 cubic metres per day
Minimum hydraulic loading	0.528 cubic metres per day	2.64 cubic metres per day
Average hydraulic loading (Qi)	1.6 cubic metres per day	8.0 cubic metres per day
Effluent flow (Qe)	1.6 cubic metres per day	8.0 cubic metres per day
Dilution compensation factor (Qi/Qe)	1	1
Geometric Mean of total Suspended Solids	<5 milligrams per litre	<5 milligrams per litre
Geometric Mean of the thermotolerant faecal coliform count	Not detected	Not detected
Geometric Mean of BOD ₅ without nitrification	2 milligrams per litre	2 milligrams per litre
Geometric Mean of COD	12 mg/l	12 mg/l
Geometric Mean of total nitrogen	Not Applicable mg/l	Not Applicable mg/l
Geometric Mean of total phosphorus	Not Applicable mg/l	Not Applicable mg/l
Maximum pH	8.1 + 8.0	8.1 + 8.0
Minimum pH	7.6 + 7.6	7.6 + 7.3
Type of disinfectant used	Ultraviolet and Copper-Silver Ionization	Ultraviolet and Copper-Silver Ionization
If Chloride - free available Chloride:	N/A	N/A
Maximum	--	--
Minimum	--	--
Geometric Mean	--	--
Was Equipment tested with Fresh Water flushing?	Yes	Yes



Page 4 of 9
Document number SAS P150071
Issue number 1

DESIGN APPRAISAL DOCUMENT

Date 23 December 2015	Quote this reference on all future communications MTES/MARPOL/TA/JDM/WP21497274
--------------------------	--

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS P150071

Salt Water flushing?	No	No
Fresh and Salt Water flushing?	No	No
Grey water added?	Yes	Yes
Environmental Conditions		
Temperature?	Yes (0 - 55°C)	Yes (0 - 55°C)
Humidity?	Yes (90%)	Yes (90%)
Inclination?	Yes (22.5°)	Yes (22.5°)
Vibration?	Yes (As per MEPC. 107 (49) (Part 3))	Yes (As per MEPC. 107 (49) (Part 3))
Reliability of Electrical and Electronic Equipment	Yes	Yes

Was the sewage treatment plant tested against the Environmental Conditions specified in section 5.9 of resolution MEPC.227(64):

Temperature?	Yes	0 - 55°C
Humidity?	Yes	90%
Inclination?	Yes	22.5°
Vibration?	Yes	As per MEPC. 107 (49) (PART 3)
Reliability of Electrical and Electronic Equipment	Yes	

Limitations and the conditions of operation imposed:

Salinity	1.03
Temperature	0 - 55 °C
Humidity	90%
Inclination	22.5°
Vibration	As per MEPC.107 (49) (Part 3)

DESIGN APPRAISAL DOCUMENT

Date 23 December 2015	Quote this reference on all future communications MTES/MARPOL/TA/JDM/WP21497274
--------------------------	--

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS P150071

DOCUMENTS REVIEWED:

The design details and of MSD-III series, and the drawings/ documents reviewed are;

- Capacity Calculations and Design Parameters MSD-III series
- Description and explanation MSD-III series
- Summary of result of onshore performance tests for on-board wastewater treatment systems plant, type MSD-III/20 and MSD-III/100 – Project number: 09-531
- General description HMSA Advanced Waste Water Treatment system series MSD-III
- HMSA Test Protocol 05-07-2010
- HMSA Test Protocol 08-11-2010
- Results of design Calculations
- Technical Performance Specification under 22.5° Tilt condition
- MSD-III Series Tilt Sketch, 22.5° (Tilt)

In the tables below:

Designed hydraulic loading is in cubic metres per day, (m³/day),

an organic loading is in kg per day Biochemical Oxygen Demand without nitrification (BOD5 without nitrification),

Type	Designed Hydraulic Load	Organic Load (BOD5 without nitrification)	Drawings / documents reviewed
MSD-III/10	0.83 m ³ /day	0.44 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/10 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-10, TEK.NO.: MSD-III-10, Proj. No. 20110202
MSD-III/20 (Prototype)	1.65 m ³ /day	0.92 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/20 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-20, TEK.NO.: MSD-III-20, Proj. No. 20110202 • Operation and Instruction Manual MSD-III/20 • E-diagram Prototype MSD-III/20
MSD-III/30	2.48 m ³ /day	1.40 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/30 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-30, TEK.NO.: MSD-III-30, Proj. No. 20110202
MSD-III/40	3.30 m ³ /day	1.90 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/40 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-40, TEK.NO.: MSD-III-40, Proj. No. 20110202
MSD-III/50	4.10 m ³ /day	2.32 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/50 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-50, TEK.NO.: MSD-III-50, Proj. No. 20110202
MSD-III/60	4.95 m ³ /day	2.80 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/60 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-60, TEK.NO.: MSD-III-60, Proj. No. 20110202

DESIGN APPRAISAL DOCUMENT

Date 23 December 2015	Quote this reference on all future communications MTES/MARPOL/TA/JDM/WP21497274
--------------------------	--

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS P150071

Type	Designed Hydraulic Load	Organic Load (BOD5 without nitrification)	Drawings / documents reviewed
MSD-III/70	5.78 m ³ /day	3.30 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/70 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-70, TEK.NO.: MSD-III-70, Proj. No. 20110202
MSD-III/80	6.60 m ³ /day	3.76 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/80 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-80, TEK.NO.: MSD-III-80, Proj. No. 20110202
MSD-III/100 (Prototype)	8.25 m ³ /day	4.68 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/100 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-100, TEK.NO.: MSD-III-100, Proj. No. 20110202 • Operation and Instruction Manual MSD-III/100 • E-diagram Prototype MSD-III/100
MSD-III/120	9.89 m ³ /day	5.64 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/120 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-120, TEK.NO.: MSD-III-120, Proj. No. 20110202
MSD-III/140	11.54 m ³ /day	6.56 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/140 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-140, TEK.NO.: MSD-III-140, Proj. No. 20110202
MSD-III/160	13.22 m ³ /day	7.52 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/160 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-160, TEK.NO.: MSD-III-160, Proj. No. 20110202
MSD-III/200	16.50 m ³ /day	9.40 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/200 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-200, TEK.NO.: MSD-III-200, Proj. No. 20110202
MSD-III/240	19.79 m ³ /day	11.28 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/240 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-240, TEK.NO.: MSD-III-240, Proj. No. 20110202
MSD-III/280	23.11 m ³ /day	13.02 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/280 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-280, TEK.NO.: MSD-III-280, Proj. No. 20110202
MSD-III/320	26.40 m ³ /day	15.08 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/320 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-320, TEK.NO.: MSD-III-320, Proj. No. 20110202
MSD-III/400	33.01 m ³ /day	18.84 Kg. BOD5/day	<ul style="list-style-type: none"> • MSD-III/400 Calculations and Specifications • Biological Sewage Treatment System Type MSD-III-400, TEK.NO.: MSD-III-400, Proj. No. 20110202

In the MSD-III-VAC design, these models are designed to be used with vacuum toilets. There is no upstream mixing tank, but the dilution is added to the first stage tank to dilute the effluent to that equivalent to a gravity toilet. The MSD-III-VAC system design is similar to MSD-III design, except for the dilution inlet pipe into the first stage.

DESIGN APPRAISAL DOCUMENT

Date 23 December 2015	Quote this reference on all future communications MTES/MARPOL/TA/JDM/WP21497274
--------------------------	--

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS P150071

Drawing: Flow Diagram MSD-III-VAC Proj No 20110202 Rev 00, dated 21-10-2011

Type	Designed Hydraulic Load (Sewage + Dilution)	Organic Load (BOD5 without nitrification)	Drawings / documents reviewed
MSD-III-VAC/10	0.83 m ³ /day	0.44 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/10 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-10, TEK.NO.: MSD-III-10, Proj. No. 20110202
MSD-III-VAC/20	1.65 m ³ /day	0.92 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/20 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-20, TEK.NO.: MSD-III-20, Proj. No. 20110202 Operation and Instruction Manual MSD-III/20 E-diagram Prototype MSD-III/20
MSD-III-VAC/30	2.48 m ³ /day	1.40 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/30 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-30, TEK.NO.: MSD-III-30, Proj. No. 20110202
MSD-III-VAC/40	3.30 m ³ /day	1.90 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/40 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-40, TEK.NO.: MSD-III-40, Proj. No. 20110202
MSD-III-VAC/50	4.10 m ³ /day	2.32 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/50 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-50, TEK.NO.: MSD-III-50, Proj. No. 20110202
MSD-III-VAC/60	4.95 m ³ /day	2.80 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/60 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-60, TEK.NO.: MSD-III-60, Proj. No. 20110202
MSD-III-VAC/70	5.78 m ³ /day	3.30 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/70 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-70, TEK.NO.: MSD-III-70, Proj. No. 20110202
MSD-III-VAC/80	6.60 m ³ /day	3.76 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/80 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-80, TEK.NO.: MSD-III-80, Proj. No. 20110202
MSD-III-VAC/100	8.25 m ³ /day	4.68 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/100 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-100, TEK.NO.: MSD-III-100, Proj. No. 20110202 Operation and Instruction Manual MSD-III/100 E-diagram Prototype MSD-III/100

DESIGN APPRAISAL DOCUMENT

Date 23 December 2015	Quote this reference on all future communications MTES/MARPOL/TA/JDM/WP21497274
--------------------------	--

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS P150071

Type	Designed Hydraulic Load (Sewage + Dilution)	Organic Load (BOD5 without nitrification)	Drawings / documents reviewed
MSD-III-VAC/120	9.89 m ³ /day	5.64 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/120 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-120, TEK.NO.: MSD-III-120, Proj. No. 20110202
MSD-III-VAC/140	11.54 m ³ /day	6.56 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/140 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-140, TEK.NO.: MSD-III-140, Proj. No. 20110202
MSD-III-VAC/160	13.22 m ³ /day	7.52 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/160 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-160, TEK.NO.: MSD-III-160, Proj. No. 20110202
MSD-III-VAC/200	16.50 m ³ /day	9.40 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/200 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-200, TEK.NO.: MSD-III-200, Proj. No. 20110202
MSD-III-VAC/240	19.79 m ³ /day	11.28 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/240 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-240, TEK.NO.: MSD-III-240, Proj. No. 20110202
MSD-III-VAC/280	23.11 m ³ /day	13.02 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/280 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-280, TEK.NO.: MSD-III-280, Proj. No. 20110202
MSD-III-VAC/320	26.40 m ³ /day	15.08 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/320 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-320, TEK.NO.: MSD-III-320, Proj. No. 20110202
MSD-III-VAC/400	33.01 m ³ /day	18.84 Kg. BOD5/day	<ul style="list-style-type: none"> MSD-III/400 Calculations and Specifications Biological Sewage Treatment System Type MSD-III-400, TEK.NO.: MSD-III-400, Proj. No. 20110202

CONDITIONS OF CERTIFICATION

1. A plate or durable label containing data of the manufacturer's name, type and serial numbers of the equipment, hydraulic loading and data of the manufacturer is to be fitted on each sewage treatment plant
2. Production items are to be manufactured in accordance with a quality control system which shall be maintained to ensure that items are of the same standard as the approved prototype
3. A copy of this certificate shall be carried on board any ship equipped with the above described sewage treatment plant
4. For redundancy purpose, duplicate discharge pump, blower, filter pump, back flush pump, circulation pump, UV disinfection reactor and copper ion generator may be fitted



Page 9 of 9
Document number SAS P150071
Issue number 1

DESIGN APPRAISAL DOCUMENT

Date 23 December 2015	Quote this reference on all future communications MTES/MARPOL/TA/JDM/WP21497274
--------------------------	--

ATTACHMENT TO CERTIFICATE OF TYPE APPROVAL No. SAS P150071

5. Additional copper ion generator may be fitted in third stage of models MSD-III/10, MSD-III/20, MSD-III/30, MSD-III/40, MSD-III/50, MSD-III/60, MSD-III/70, MSD-III-VAC/10, MSD-III-VAC/20, MSD-III-VAC/30, MSD-III-VAC/40, MSD-III-VAC/50, MSD-III-VAC/60 and MSD-III-VAC/70
6. Pressure transmitter may be used in place of level switch to obtain continuous reading of the tank level in ship's monitoring system
7. Additional ultra-filtration may be fitted, which takes treated effluent from MSD-III as feed water to improve further the quality of finally discharged water. This does not part of type approval
8. There is an option "automatic sludge pump action" which involves routing two valves (air and discharge) and starting a pump. Disposal of the sewage sludge is the responsibility of the vessel. Drawing number P&ID MSD-III Sludge Pump Action Rev 00 Dated 15-02-2015 and MSD-III Biological Sewage Treatment Plant Operating & Instruction Manual text revisions

PLACES OF PRODUCTION

Holland Marine Services Amsterdam BV
Volthavenweg 16
1013 BJ Amsterdam
The Netherlands



Jonathan D. Morley,
Lead Specialist
MARPOL and Engineering Systems
Marine Technology and Engineering Services
Lloyd's Register EMEA

Supplementary Type Approval Terms and Conditions

This certificate and Design Appraisal Document relates to type approval, it certifies that the prototype(s) of the product(s) referred to herein has/have been found to meet the applicable design criteria for the use specified herein, it does not mean or imply approval for any other use, nor approval of any products designed or manufactured otherwise than in strict conformity with the said prototype(s).