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Report On

Limited Environmental Approval Testing of the
SRT Marine Limited
Mercury SART
In accordance with IEC 60945 and IEC 61097-14

Document 75917539 Report 09 Issue 2

November 2012



Product Service

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REPORT ON

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SRT Marine Limited
Mercury SART
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Document 75917539 Report 09 Issue 2

November 2012

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PREPARED BY

A handwritten signature in black ink, appearing to read 'M. Hardy'.

M Hardy
Test Engineer

APPROVED BY

A handwritten signature in black ink, appearing to read 'R. Thompson'.

R Thompson
Authorised Signatory

DATED

23 November 2012

This report has been up-issued to Issue 2 to include additional results.





Product Service

CONTENTS

| Section | Page No |
|----------|--|
| 1 | REPORT SUMMARY 3 |
| 1.1 | Introduction 4 |
| 1.2 | Brief Summary of Results 5 |
| 1.3 | Declaration of Build Status 6 |
| 1.4 | Product Information 7 |
| 1.5 | Deviations from the Standard 9 |
| 1.6 | Modification Record 9 |
| 2 | TEST RESULTS 10 |
| 2.1 | Dry Heat (Storage) 11 |
| 2.2 | Dry Heat (Functional) 14 |
| 2.3 | Damp Heat 17 |
| 2.4 | Low Temperature (Storage) 20 |
| 2.5 | Low Temperature (Functional) 23 |
| 2.6 | Thermal Shock 26 |
| 2.7 | Vibration 28 |
| 2.8 | Immersion 37 |
| 2.9 | Floating Test 39 |
| 2.10 | Drop onto Hard Surface 41 |
| 2.11 | Drop Into Water 43 |
| 3 | TEST EQUIPMENT USED 45 |
| 3.1 | Test Equipment Used 46 |
| 4 | PHOTOGRAPHS 47 |
| 4.1 | Photographs of Equipment Under Test (EUT) 48 |
| 5 | ACCREDITATION, DISCLAIMERS AND COPYRIGHT 50 |
| 5.1 | Accreditation, Disclaimers and Copyright 51 |



Product Service

SECTION 1

REPORT SUMMARY

Limited Environmental Approval Testing of the
SRT Marine Limited Mercury SART
in accordance with IEC 60945 and IEC 61097-14



Product Service

1.1 INTRODUCTION

The information contained in this report is intended to show limited verification of the Approval Testing of the SRT Marine Limited Mercury SART to the requirements of IEC 60945 and IEC 61097-14.

| | |
|-------------------------------|---|
| Objective | To perform Type Approval Testing to determine the Equipment Under Test's (EUT's) compliance with the Test Specification, for the series of tests carried out. |
| Manufacturer | SRT Marine Limited |
| Model Number(s) | Mercury SART |
| Serial Number(s) | 40900023120217 TUV REF: 75917539-TSR0032 40900023120222 TUV REF: 75917539-TSR0030 MMSI 970460016 TUV REF: 75917539-TSR0034 |
| Number of Samples Tested | Three |
| Test Specification/Issue/Date | IEC 60945: 2002 IEC 61097-14: 2010-02 |
| Order Number | POR002829 |
| Date | 19 December 2011 |
| Start of Test | 20 September 2012 |
| Finish of Test | 19 November 2012 |
| Name of Engineer(s) | C Bowles K Bryant F Van Niekerk C Foster R Hampton A Guy S Dennison J Holcombe M Hardy |



Product Service

1.2 BRIEF SUMMARY OF RESULTS

A brief summary of the tests carried out in accordance with IEC 60945 and IEC 61097-14 is shown below.

| Section | IEC 61097-14 Spec Clause | IEC 60945 Spec Clause | Test Description | Result | Comments |
|---------|--------------------------|-----------------------|------------------------------|--------------|--|
| 2.1 | - | 8.2 | Dry Heat (Storage) | Satisfactory | - |
| 2.2 | - | 8.2.2 | Dry Heat (Functional) | Satisfactory | - |
| 2.3 | - | 8.3 | Damp Heat | Satisfactory | - |
| 2.4 | - | 8.4 | Low Temperature (Storage) | Satisfactory | - |
| 2.5 | - | 8.4.2.2 | Low Temperature (Functional) | Satisfactory | - |
| 2.6 | 6.1 g | 8.5 | Thermal Shock | Satisfactory | - |
| 2.7 | - | 8.7 | Vibration | Satisfactory | - |
| 2.8 | 6.1 f | 8.9 | Immersion | Satisfactory | It was observed that the EUT was active on removing from the pressure chamber. |
| 2.9 | 6.1 h | - | Floating test | Satisfactory | - |
| 2.10 | - | 8.6.1 | Drop onto Hard surface | Satisfactory | It was observed that the LED illuminated on each impact. |
| 2.11 | 6.1 e | 8.6.2 | Drop into Water | Satisfactory | - |

1.3 DECLARATION OF BUILD STATUS

DECLARATION OF BUILD STATUS

| MAIN EUT | | | |
|--|---|------------------------|--|
| MANUFACTURING DESCRIPTION | SART (Search and Rescue Transponder) | | |
| MANUFACTURER | SRT-Marine | | |
| TYPE | Mercury SART | | |
| PART NUMBER | 409-0002 | | |
| SERIAL NUMBER | | | |
| HARDWARE VERSION | 2 | | |
| SOFTWARE VERSION | 070200.01.01 | | |
| TRANSMITTER OPERATING RANGE | 161.975-162.025 MHz | | |
| RECEIVER OPERATING RANGE | N/A | | |
| INTERMEDIATE FREQUENCIES | N/A | | |
| EMISSION DESIGNATOR(S): (i.e. G1D, GXW) | 12K5G/XW | | |
| MODULATION TYPES: (i.e. GMSK, QPSK) | GMSK TDMA | | |
| HIGHEST INTERNALLY GENERATED FREQUENCY | 162.025 | | |
| HIGHEST INTERNALLY GENERATED FREQUENCY IN RECEIVE IDLE MODE | 162.025 MHz | | |
| OUTPUT POWER (W or dBm) | 1W | | |
| TECHNICAL DESCRIPTION (a brief description of the intended use and operation) | A Search and Rescue Transponder (SART) is a self-contained, waterproof AIS transponder intended for emergency use at sea. The AIS SART is used to locate a survival craft or distressed vessel by creating a series of dots on a rescuing ship's AIS display. | | |
| If unit is SRD being tested to ETS 301 489-3 please state Class of Equipment as defined in Section 6.1 | N/A | | |
| BATTERY/POWER SUPPLY | | | |
| MANUFACTURING DESCRIPTION | Lithium Cylindrical | | |
| MANUFACTURER | VARTA Microbattery GmbH | | |
| TYPE | Li-MNO2 | | |
| PART NUMBER | 2/CR 2/3 AH | | |
| VOLTAGE | 8 (2 x 3V) | | |
| SERIAL NUMBER | | | |
| ANCILLARIES (if applicable) | | | |
| MANUFACTURING DESCRIPTION | Pole | Lanyard | |
| MANUFACTURER | QPC | PT Winchester | |
| TYPE | 1 m pole | 2mm polypropylene rope | |
| PART NUMBER | 300-0063 | 184-0001 | |
| SERIAL NUMBER | N/A | N/A | |

Signature



Date

03.09.12

D of B S Serial No

Note: This document has been prepared to enable manufacturers with no mechanism for producing their own Declaration of Build Status, to declare the build state of the equipment submitted for test.

No responsibility will be accepted by TÜV Product Service as to the accuracy of the information declared in this document by the manufacturer.

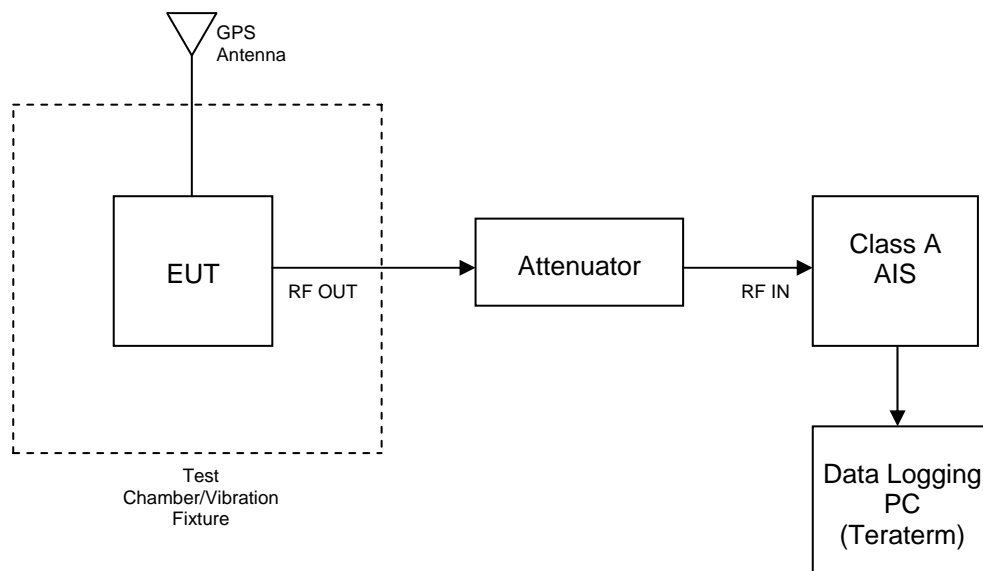
1.4 PRODUCT INFORMATION

1.4.1 Technical Description

The Equipment Under Test (EUT) was a SRT Marine Limited Mercury SART as shown in the photograph below. A full technical description can be found in the manufacturer's documentation.



Equipment Under Test

Test Setup Diagram

The Class A AIS device was used to receive transmissions from the EUT. The PC was used with Teraterm data logging software to monitor messages transmitted by the EUT.



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1.5 DEVIATIONS FROM THE STANDARD

No deviations from the applicable test standards or test plan were made during testing.

1.6 MODIFICATION RECORD

No modifications were made to the EUT during testing.



Product Service

SECTION 2

TEST RESULTS

Limited Environmental Approval Testing of the
SRT Marine Limited Mercury SART
in accordance with IEC 60945 and IEC 61097-14



Product Service

2.1 DRY HEAT (STORAGE)

2.1.1 Specification Reference

IEC 60945:2002 Clause 8.2.1

2.1.2 Equipment Under Test

Mercury SART: 40900023120217 TUV REF: 75917539-TSR0032

2.1.3 Date of Test and Modification State

21 to 22 September 2012 – Modification State 0

2.1.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.1.5 Environmental Conditions

Ambient Temperature 24.8 - 24.9°C

Relative Humidity 45.9 - 46.7%

2.1.6 Test Procedure

The EUT was placed in the environmental chamber at laboratory ambient conditions.

The temperature of the chamber was then raised to +70 °C for a period of 14 hours.

The temperature of the chamber was then returned to laboratory ambient and a performance check was carried out.

2.1.7 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle.

Test Setup



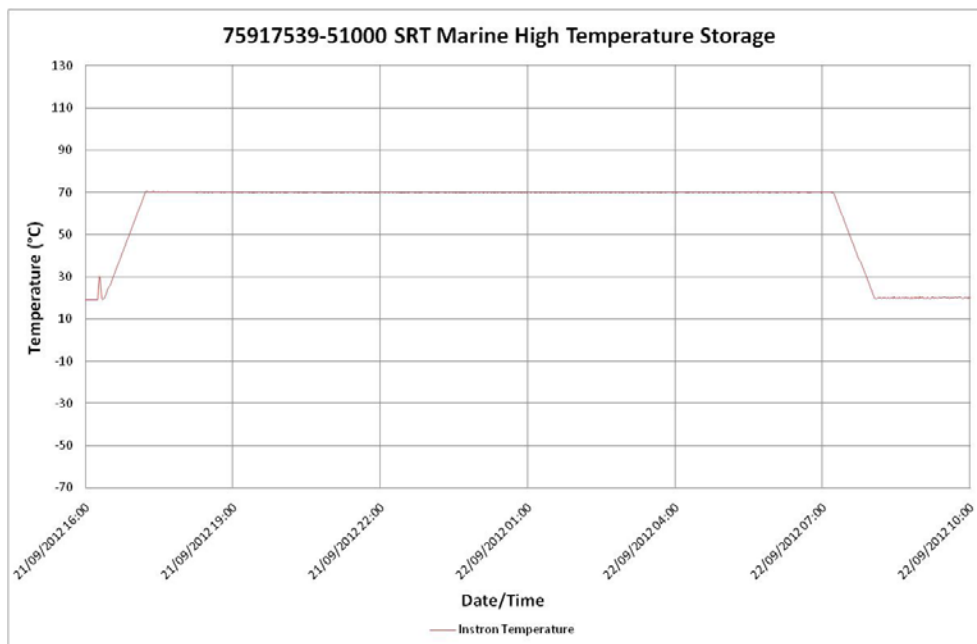


Product Service

2.1.8 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Temperature Plot



Performance Check

The customer declared that the performance check carried out after the test by TUV was satisfactory.



Product Service

2.2 DRY HEAT (FUNCTIONAL)

2.2.1 Specification Reference

IEC 60945:2002 Clause 8.2.1

2.2.2 Equipment Under Test

Mercury SART: MMSI 970460016 TUV REF: 75917539-TSR0034

2.2.3 Date of Test and Modification State

14 to 15 November 2012 – Modification State 0

2.2.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.2.5 Environmental Conditions

Ambient Temperature 21.7 – 22.5°C

Relative Humidity 36.1 – 32.5%

2.2.6 Test Procedure

The EUT was switched on and placed in the environmental chamber at laboratory ambient conditions. The temperature of the chamber was then raised to +55 °C for a period of 16 hours. During this time the EUT was operational throughout and the performance check carried out. The temperature of the chamber was then returned to laboratory ambient and a performance check was carried out.

2.2.7 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Powered.

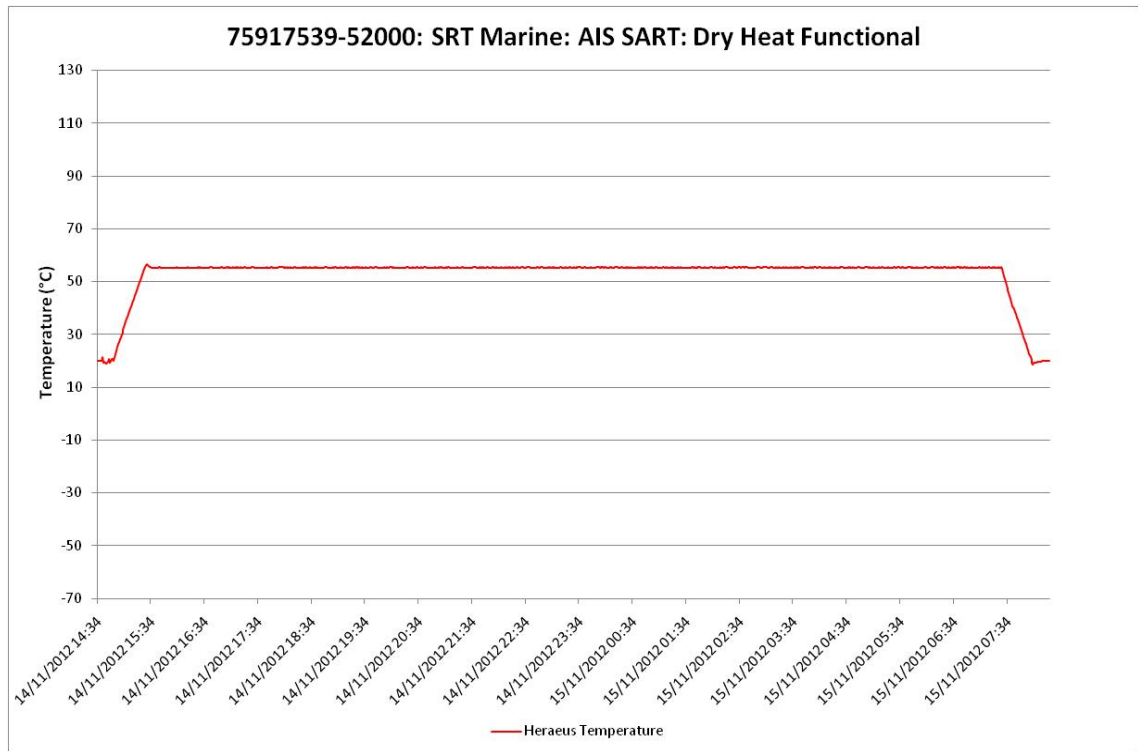
Test Setup (dry heat and low temperature functional)



2.2.8 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Temperature Plot



Performance Check

The customer declared that the performance check carried out after the test by TUV was satisfactory.



Product Service

2.3 DAMP HEAT

2.3.1 Specification Reference

IEC 60945:2002 Clause 8.3

2.3.2 Equipment Under Test

Mercury SART: 40900023120217 TUV REF: 75917539-TSR0032

2.3.3 Date of Test and Modification State

25 to 26 September 2012 - Modification State 0

2.3.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.3.5 Environmental Conditions

Ambient Temperature 23.9°C

Relative Humidity 45.8%

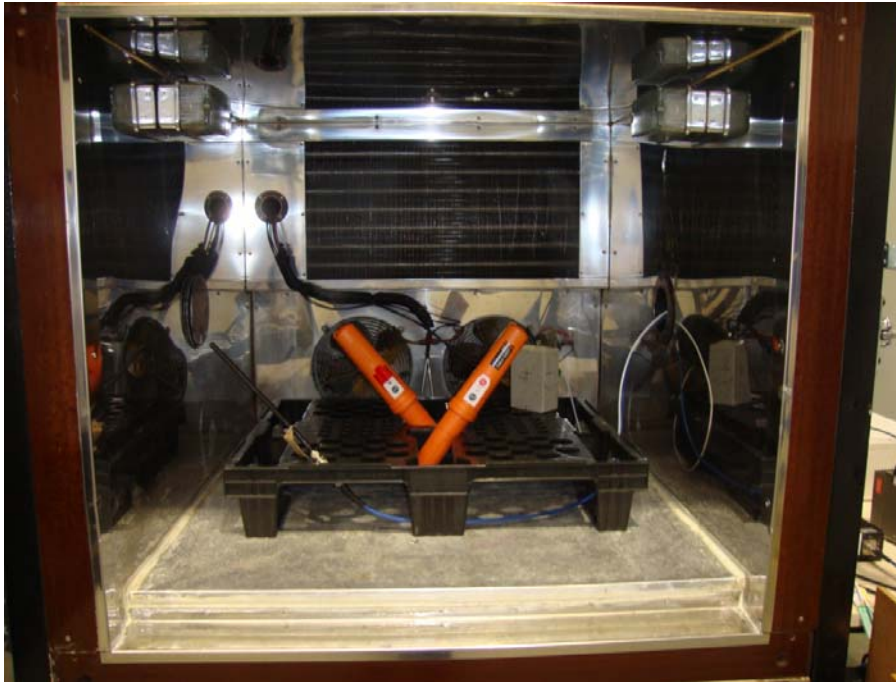
2.3.6 Test Procedure

The EUT (powered off) was placed in the environmental chamber at laboratory ambient conditions. The temperature of the chamber was then raised to +40 °C and the relative humidity raised to 93% over a period of 3 hours. The conditions were maintained for a period of 15 hours during which time the performance check was carried out. The EUT continued to operate for at least 2 hours. Once the performance check was complete the chamber conditions were returned to laboratory ambient.

2.3.7 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle and Operating.

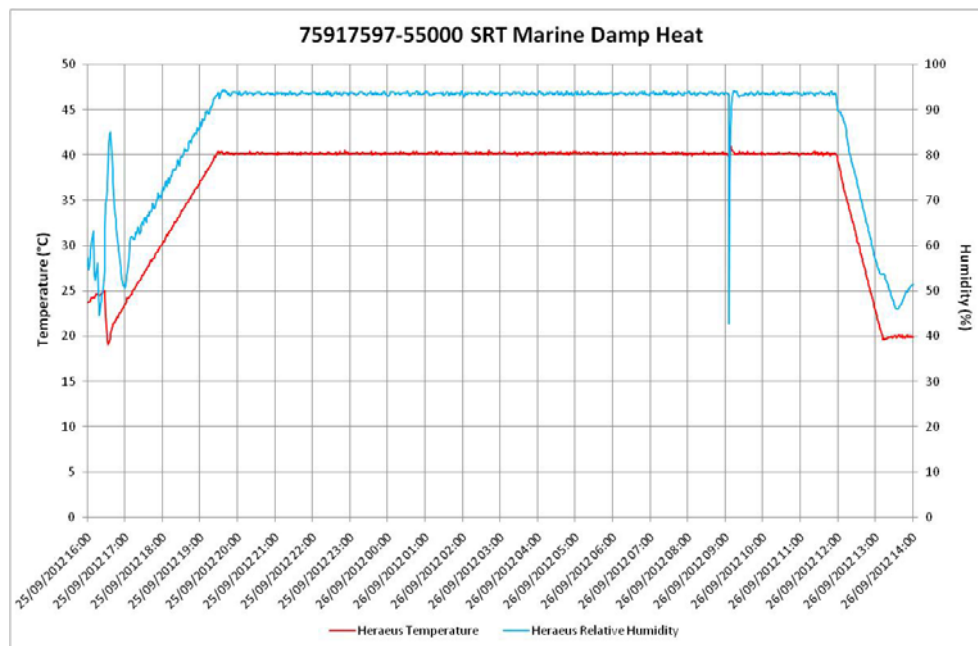
Test Set Up



2.3.8 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Temperature Plot



Performance Check

The customer declared that the performance check carried out during the operational period by TUV was satisfactory.



Product Service

2.4 LOW TEMPERATURE (STORAGE)

2.4.1 Specification Reference

IEC 60945:2002 Clause 8.4.1

2.4.2 Equipment Under Test

Mercury SART: 40900023120217 TUV REF: 75917539-TSR0032

2.4.3 Date of Test and Modification State

20 to 21 September 2012 - Modification State 0

2.4.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.4.5 Environmental Conditions

Ambient Temperature 22.7°C

Relative Humidity 45.6%

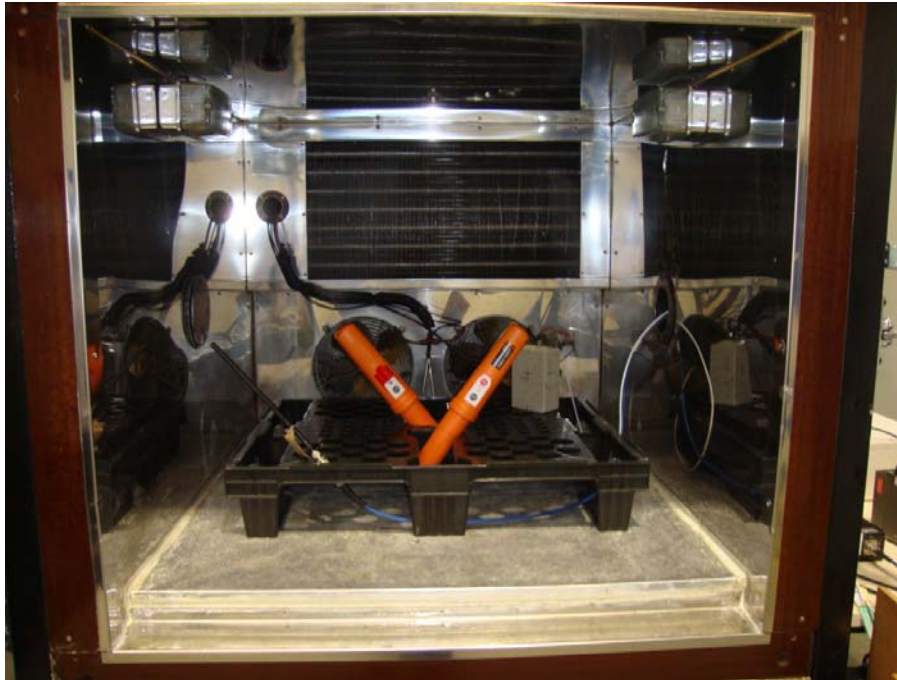
2.4.6 Test Procedure

The EUT was placed in the environmental chamber at laboratory ambient conditions and the temperature of the chamber was then lowered to -30 °C. The conditions were maintained for a period of 15 hours after which the temperature of the chamber was then returned to laboratory ambient and a performance check was carried out.

2.4.7 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle.

Setup Photo



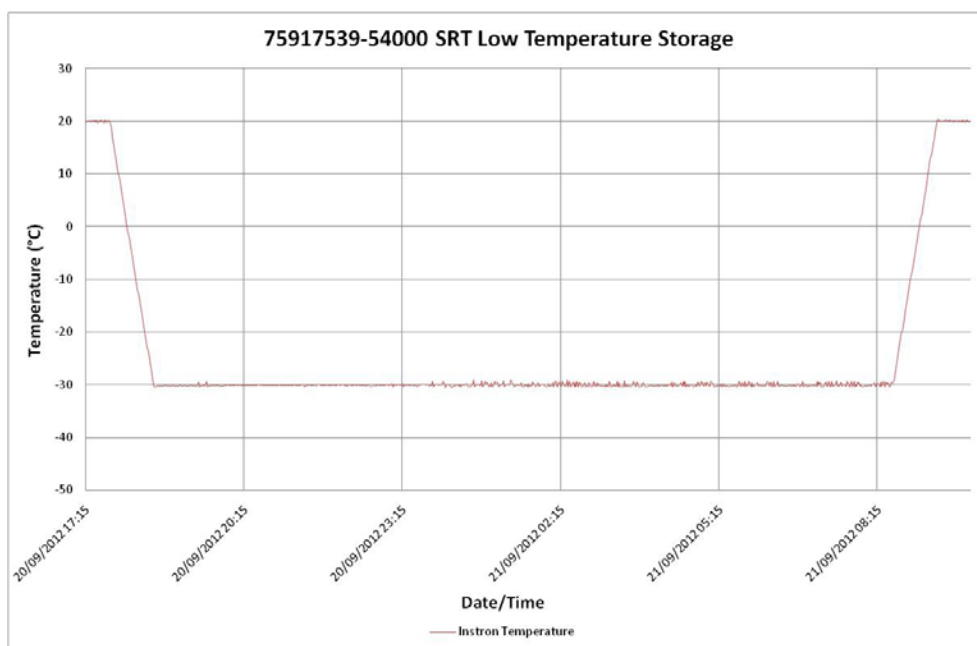


Product Service

2.4.8 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Temperature Plot



Performance Check

The customer declared that the performance check carried out by TUV after the test was satisfactory.



Product Service

2.5 LOW TEMPERATURE (FUNCTIONAL)

2.5.1 Specification Reference

IEC 60945:2002 Clause 8.4.1

2.5.2 Equipment Under Test

Mercury SART: MMSI 970460016 TUV REF: 75917539-TSR0034

2.5.3 Date of Test and Modification State

18 to 19 November 2012 - Modification State 0

2.5.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.5.5 Environmental Conditions

Ambient Temperature 16.6 – 17.6°C

Relative Humidity 33.0 - 41%

2.5.6 Test Procedure

The EUT was placed in the environmental chamber at laboratory ambient conditions and the temperature of the chamber was then lowered to -20 °C. After 10 hours the EUT was powered on and allowed to operate for 2 hours. The performance check was carried out during this time after which the temperature of the chamber was then returned to laboratory ambient.



Product Service

2.5.7 Test Set-up and Operating Modes

The test was performed with the EUT in the following mode(s): Idle and Operating

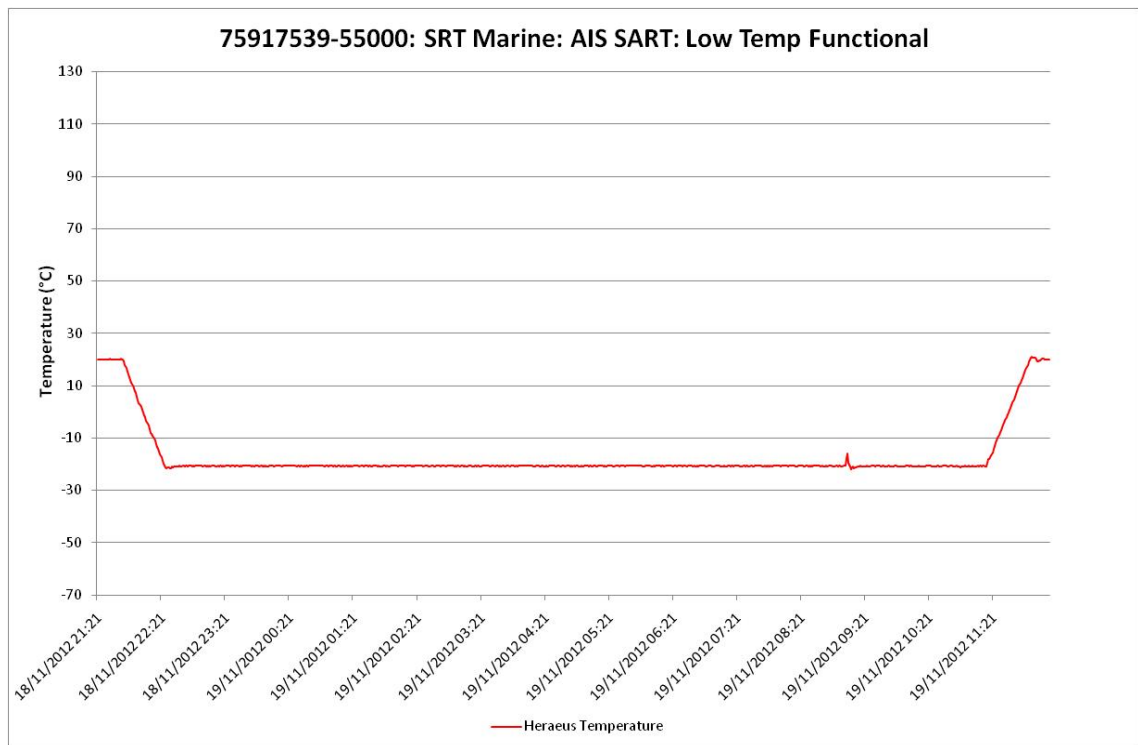
Setup Photo

See Section 2.2 for setup photo.

2.5.8 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Temperature Plot



Performance Check

The customer declared that the performance check carried out by TUV after the test was satisfactory.



Product Service

2.6 THERMAL SHOCK

2.6.1 Specification Reference

IEC 60945:2002, clause 8.5 and IEC 61097-14, clause 6.1 g

2.6.2 Equipment Under Test

Mercury SART: 40900023120217 TUV REF: 75917539-TSR0032

2.6.3 Date of Test and Modification State

01 October 2012 – Modification State 0

2.6.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.6.5 Environmental Conditions

Ambient Temperature 24.3°C

Relative Humidity 33.7%

2.6.6 Test Method

The EUT was placed in the pre-conditioning climatic chamber at a temperature of 70°C for 1 hour.

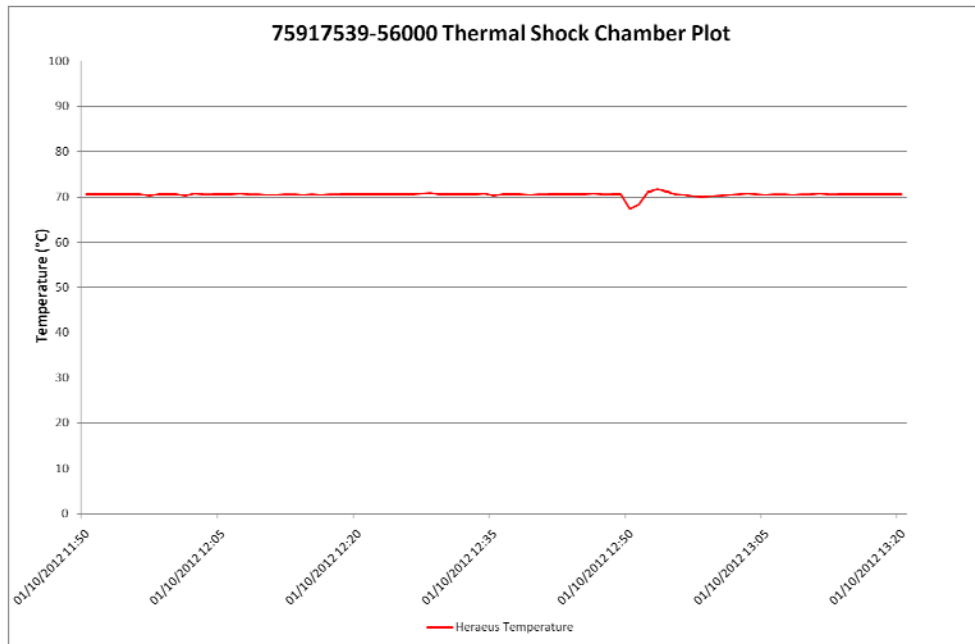
The EUT was then immersed in a water vessel at 25°C, at a level of 100mm below the surface of the water (measured to the highest point of the EUT) for a period of 1 hour.

At the conclusion of the test, the EUT was inspected for unwanted ingress of water, and subjected to a performance check.

2.6.7 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Preconditioning Temperature Plot



Setup Photo



Performance Check

The customer declared that the performance check carried out after the test by TUV was satisfactory.



Product Service

2.7 VIBRATION

2.7.1 Specification Reference

IEC 60945:2002, clause 8.7

2.7.2 Equipment Under Test

Mercury SART: 40900023120222 TUV REF: 75917539-TSR0030

2.7.3 Date of Test and Modification State

02 October 2012 – Modification State 0

2.7.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.7.5 Environmental Conditions

Ambient Temperature 18.9°C

Relative Humidity 59.1%

2.7.6 Test Method

The EUT was fixed to the vibration table and was subject to the following vibration profiles:

Resonance Sweep

- 5 Hz and up to 13.2 Hz with an excursion of ± 1 mm (7 m/s² maximum acceleration at 13.2 Hz);
- above 13.2 Hz and up to 100 Hz with a constant maximum acceleration of 7 m/s².

One sweep was performed at a rate of 0.5 octaves / minute.

No resonances were found therefore the unit was subjected to a 2 hour endurance run at 30 Hz in each axis.

The EUT was switched off for the first hour of each endurance run and monitored for any unintentional transmissions. During the second hour of the endurance run, the EUT was activated and a performance check carried out.

2.7.7 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Example Setup Photo



Performance Check

The customer declared that the performance check carried out by TUV during the test was satisfactory.

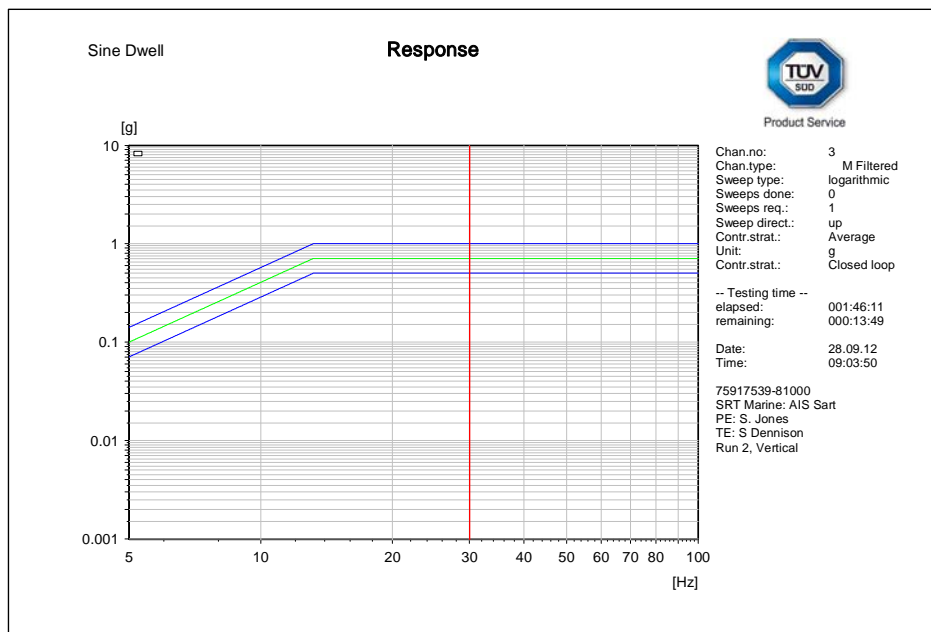
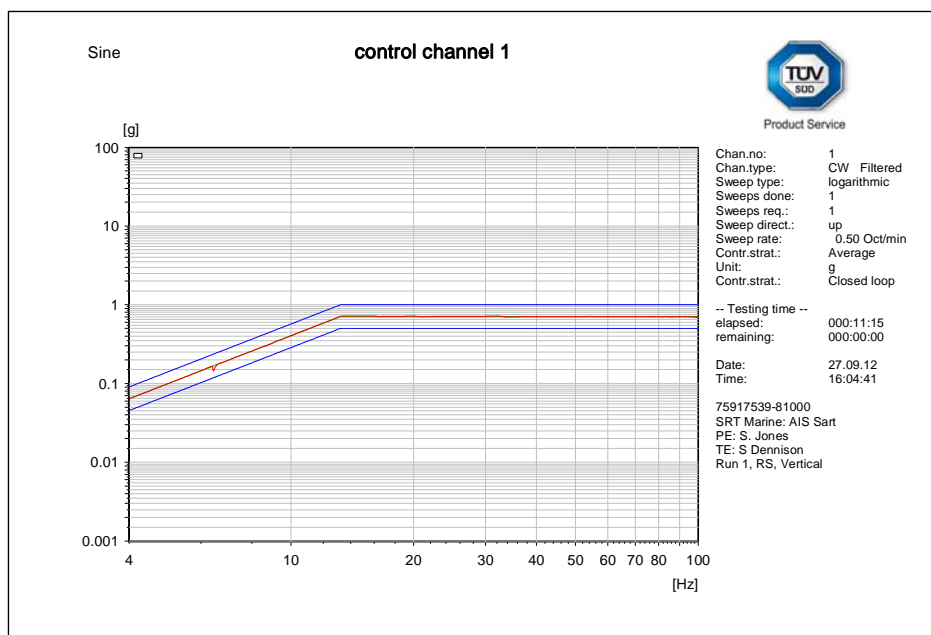


Product Service

Test Profile Plots

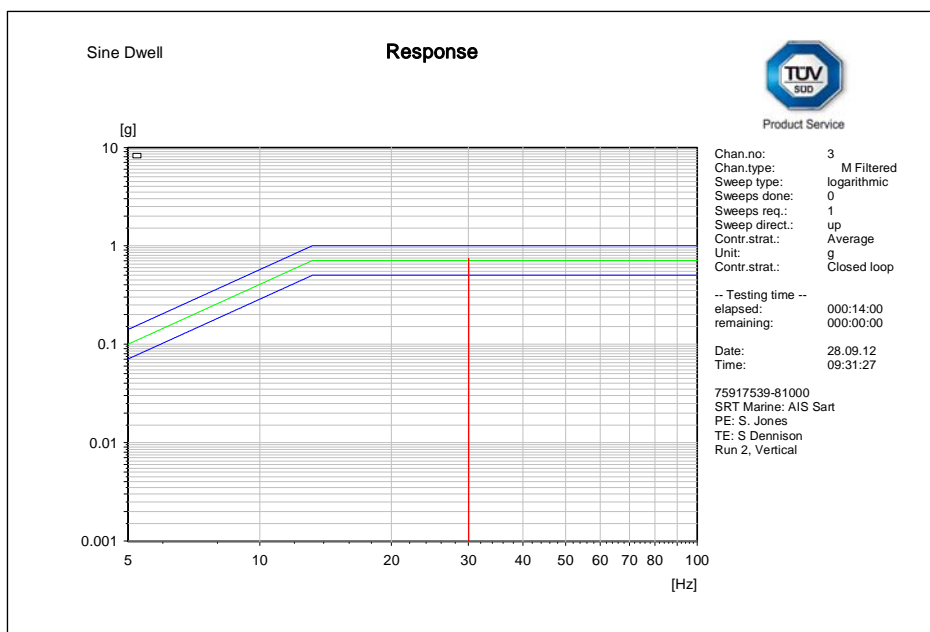
Vertical Axis

Resonant Search Plots





Product Service

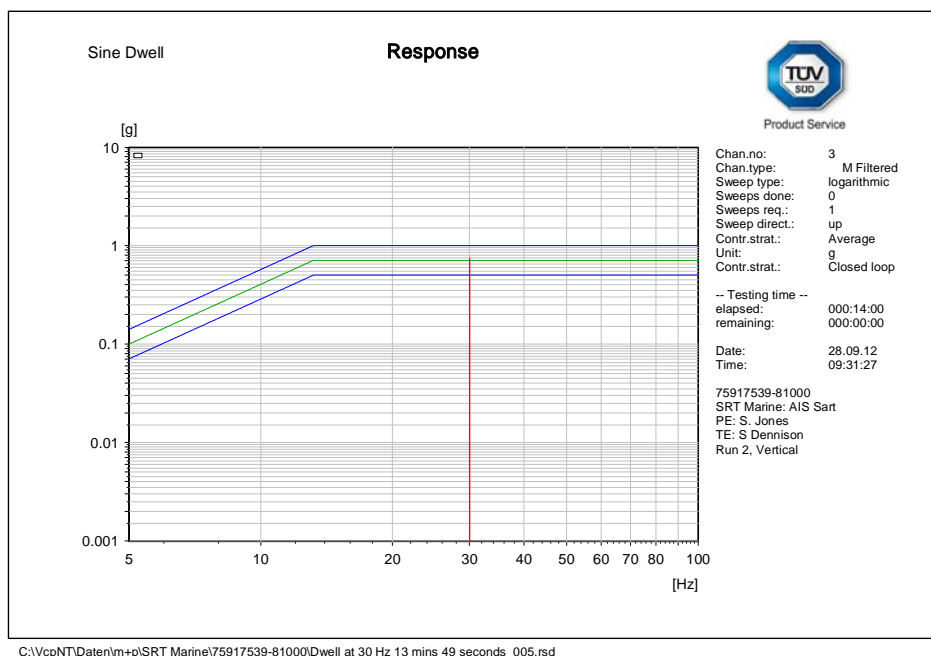
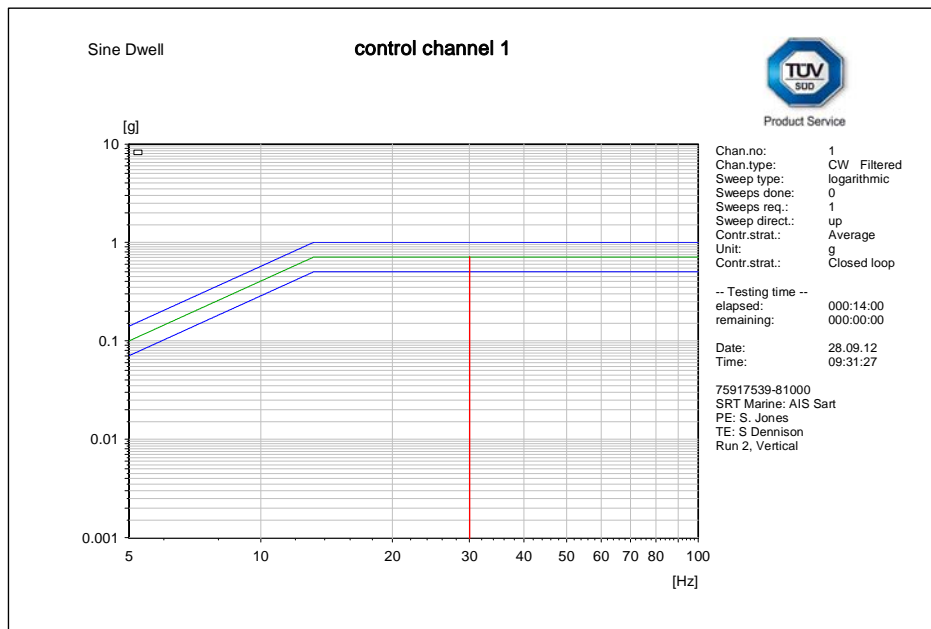




Product Service

Vertical Axis

Endurance Plots

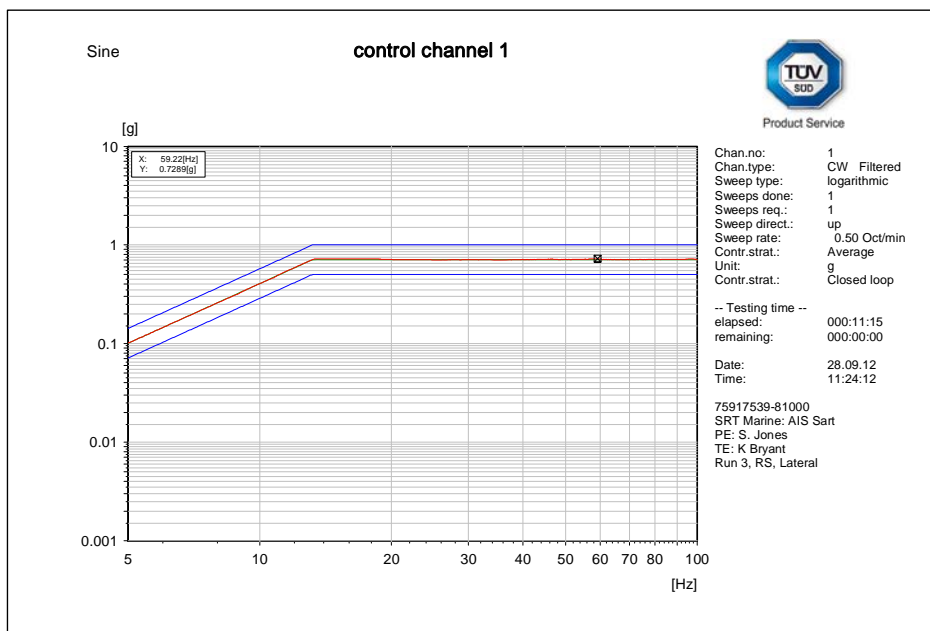




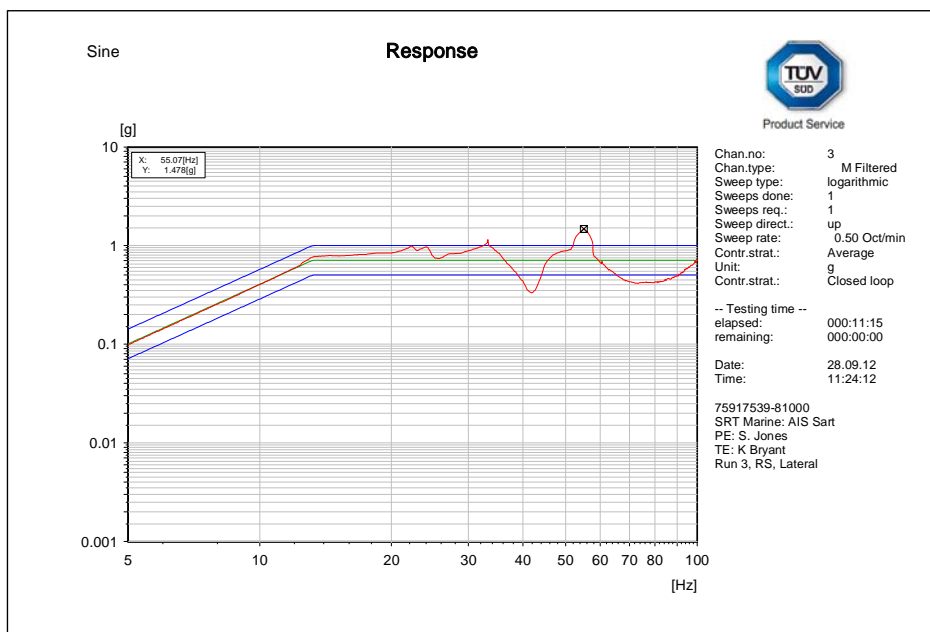
Product Service

Lateral Axis

Resonant search Plots



C:\VcpNT\Daten\m+p\SRT Marine\75917539-81000\Resonance Search_006.rsn



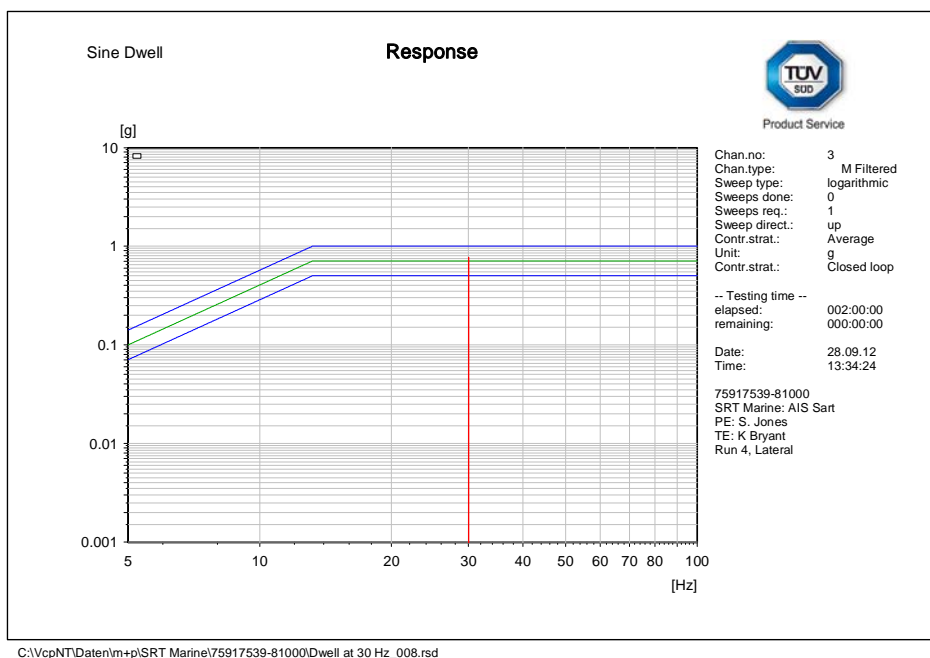
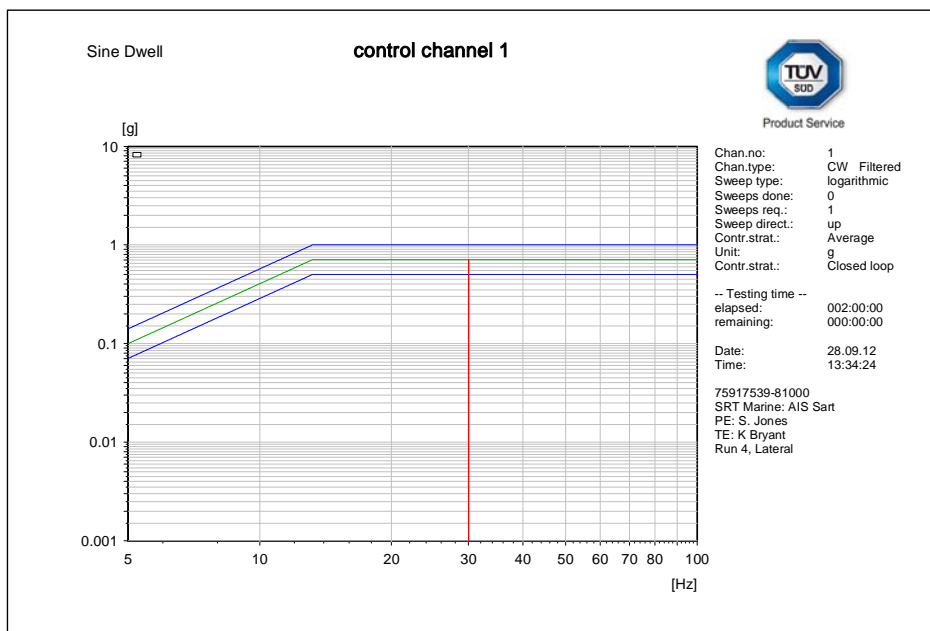
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Product Service

Lateral Axis

Endurance Plots

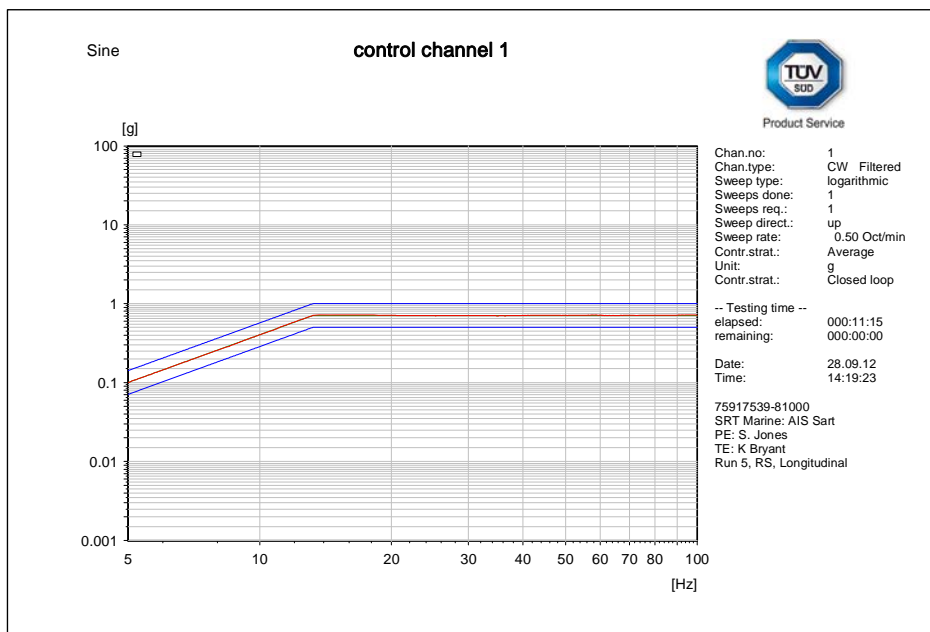




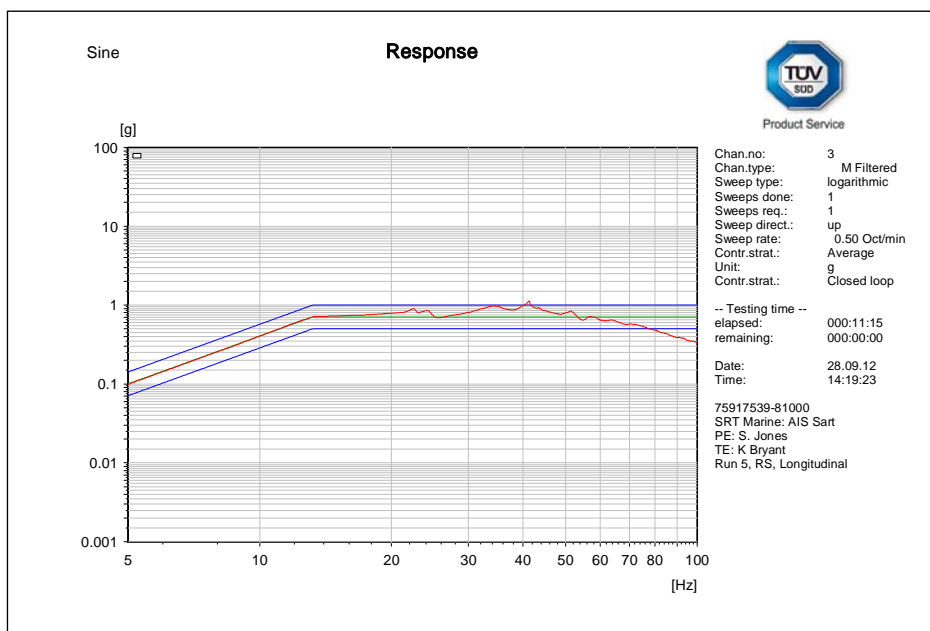
Product Service

Longitudinal Axis

Resonant Search Plots



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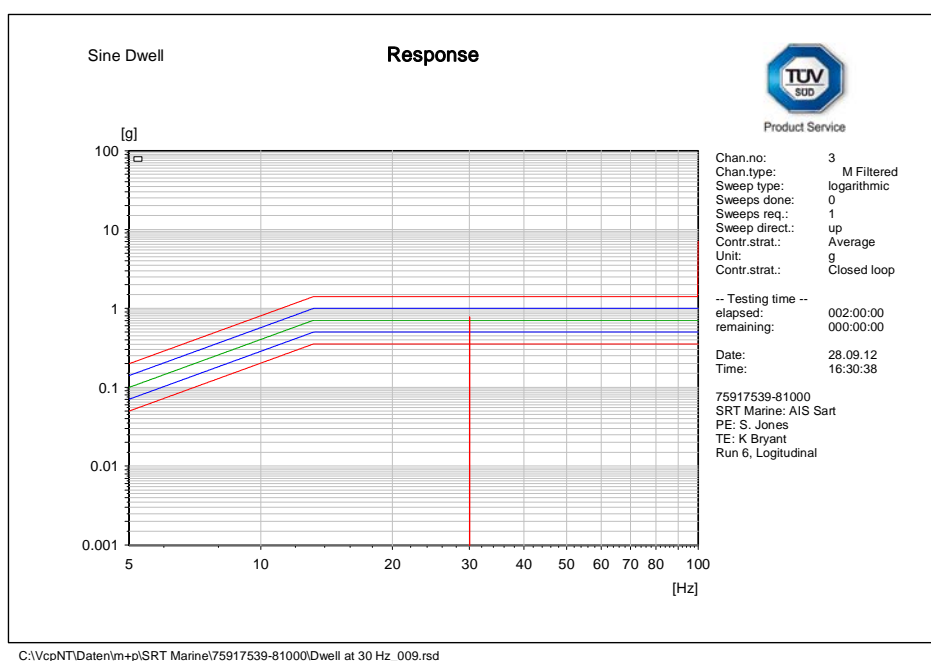
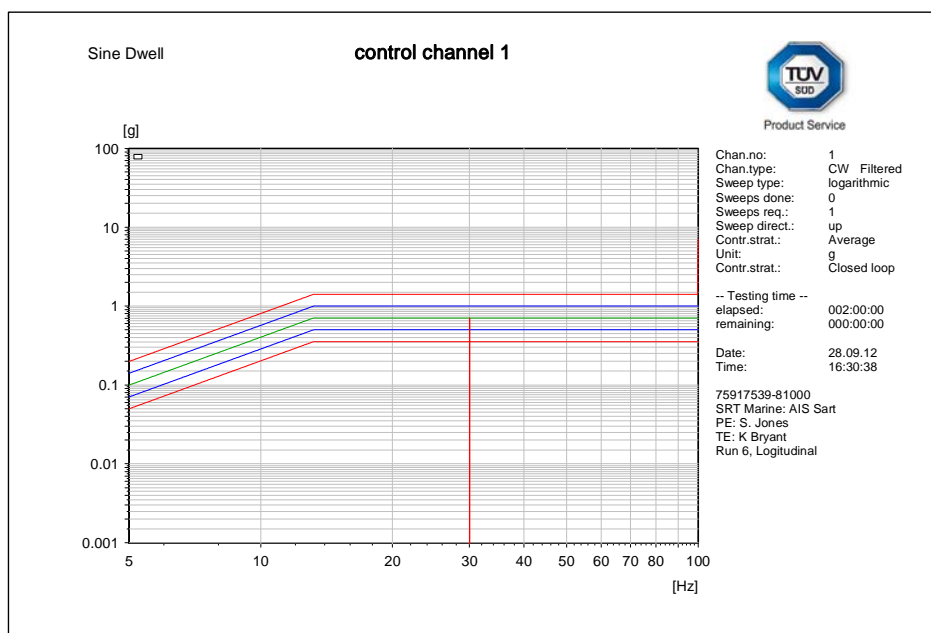
C:\VcpNT\Daten\m+p\SRT Marine\75917539-81000\Resonance Search_010.rsn



Product Service

Longitudinal Axis

Endurance Plots





Product Service

2.8 IMMERSION

2.8.1 Specification Reference

IEC 60945:2002, clause 8.9 and IEC 61097-14, clause 6.1 f

2.8.2 Equipment Under Test

Mercury SART: 40900023120217 TUV REF: 75917539-TSR0032

2.8.3 Date of Test and Modification State

03 October 2012 – Modification State 0

2.8.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.8.5 Environmental Conditions

Ambient Temperature 23.0°C

Relative Humidity 39.3%

2.8.6 Test Method

The EUT was submerged in a vessel of water, then subjected to a hydraulic pressure of 100 kPa (1 bar) for a period of 5 min.

At the end of the test the EUT was subjected to a performance check, and was examined for damage and for unwanted ingress of water.

2.8.7 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Setup Photo



Performance Check

The customer declared that the performance check carried out after the test by TUV was satisfactory.

There was no observed unwanted ingress of water.

Note: at the conclusion of the test it was observed that the EUT had activated at some point during the immersion period.



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2.9 FLOATING TEST

2.9.1 Specification Reference

IEC 61097-14 :2010 , clause 6.1 h

2.9.2 Equipment Under Test

Mercury SART: 40900023120217 TUV REF: 75917539-TSR0032

2.9.3 Date of Test and Modification State

03 October 2012 – Modification State 0

2.9.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.9.5 Environmental Conditions

Ambient Temperature 23.0°C
Relative Humidity 39.3%

2.9.6 Test Method

The EUT was fitted with a one meter mounting pole, and floated in a vessel of fresh water for a minimum of 5 minutes.

2.9.7 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Setup Photo



The reserve buoyancy of the EUT was calculated as follows:

EUT mass = 0.511Kg

EUT weight = 5.01N

Buoyant Force (multiple measurements) = 6.8N, 6.8N, 5.9N, 6.2N, 6.1N, 5.9N, 6.3N

Buoyant Force (mean) = 6.28N

Reserve Buoyancy = Buoyant Force + Weight of EUT/ Weight of EUT

Reserve Buoyancy = (6.28+5.01)/5.01 = 2.25



Product Service

2.10 DROP ONTO HARD SURFACE

2.10.1 Specification Reference

IEC 60945: 2002, clause 8.6.1

2.10.2 Equipment Under Test

Mercury SART: 40900023120222 TUV REF: 75917539-TSR0030

2.10.3 Date of Test and Modification State

03 October 2012 – Modification State 0

2.10.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.10.5 Environmental Conditions

Ambient Temperature 17.8°C
Relative Humidity 56.4%

2.10.6 Test Method

The EUT was dropped 6 times on each face from a height of 1m onto a block of solid hardwood.

2.10.7 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Setup Photo



Performance Check

The customer declared that the performance check carried out after the test by TUV was satisfactory.

There was no damage to the EUT.

Note: it was observed that the EUT LED illuminated on impact for each drop.



Product Service

2.11 DROP INTO WATER

2.11.1 Specification Reference

IEC 60945: 2002, clause 8.6.2 and IEC 61097-14: 2010, clause 6.1 e

2.11.2 Equipment Under Test

Mercury SART: 40900023120222 TUV REF: 75917539-TSR0030

2.11.3 Date of Test and Modification State

04 October 2012 – Modification State 0

2.11.4 Test Equipment Used

The major items of test equipment used for the above tests are identified in Section 3.1.

2.11.5 Environmental Conditions

Ambient Temperature 19.3°C

Relative Humidity 46.1%

2.11.6 Test Method

A series of three drops was carried out. Each drop was performed with the initial position of the EUT different from the preceding one. The height of the lowest part of the EUT under test relative to the water surface at the moment of release was $20 \text{ m} \pm 1 \text{ m}$.

At the end of the test the EUT was subjected to a performance check, and examined for damage and for unwanted ingress of water.

2.11.7 Test Results

The test was carried out satisfactorily. No damage or degradation was observed.

Setup Photo



Performance Check

The customer declared that the performance check carried out after the test by TUV was satisfactory.

There was no damage to the EUT or observed unwanted ingress of water.



Product Service

SECTION 3

TEST EQUIPMENT USED



Product Service

3.1 TEST EQUIPMENT USED

List of absolute measuring and other principal items of test equipment.

| Instrument | Manufacturer | Type No. | TE No. | Calibration Period (months) | Calibration Due |
|--|----------------|-----------------|--------|-----------------------------|-----------------|
| Section 2.1 Climatic – Dry Heat (Storage) | | | | | |
| Climatic Chamber | Instron | 906 | 2128 | 12 | 17-Oct-2012 |
| Section 2.2 Climatic – Dry Heat (Functional) | | | | | |
| Temperature Chamber | Heraeus | HC 4033 | 2174 | 12 | 16-Mar-2013 |
| Section 2.3 Climatic – Damp Heat | | | | | |
| Chamber | Heraeus | HC 4033 | 2174 | 12 | 16-Mar-2013 |
| Section 2.4 Climatic - Low Temperature (Storage) | | | | | |
| Chamber | Instron | 906 | 2128 | 12 | 17-Oct-2012 |
| Section 2.5 Climatic - Low Temperature (Functional) | | | | | |
| Chamber | Heraeus | HC 4033 | 2174 | 12 | 16-Mar-2013 |
| Section 2.6 and 2.8 Climatic - Wet Tests | | | | | |
| Over Pressure (T) | ASL (TUV) | 0 TO 15 PSI | 2125 | - | TU |
| Balance | Geniweigher | GM-11K | 2334 | 12 | 23-Apr-2013 |
| Digital Pressure Gauge | Druck | DPI 700 | 2342 | 12 | 6-Sep-2013 |
| 50N Force Gauge | Mecmesin | BFG50N | 3931 | 12 | 2-Aug-2013 |
| Stop Watch | Radio Spares | Model 694 (974) | 4025 | | 6-Aug-2013 |
| Section 2.11 Beacons - Drop Into Water | | | | | |
| Bomb Release | MOD | 1000kg | 3667 | - | TU |
| Humidity and Temperature Meter | R.S Components | 1361C | 3844 | 12 | 24-Feb |
| Section 2.10 ENV - Free Fall Drop | | | | | |
| Lansmont | Lansmont | PDT 56E | 2291 | - | TU |
| Hardwood Block | Unknown | ELM | 2650 | - | TU |
| 10 meter Tape Measure | Stanley | Fatmax 10m/33' | 4072 | - | TU |
| Section 2.7 Vibration - Sine | | | | | |
| Vibrator | Derritron | VP400 | 2286 | 6 | 10-Nov-2012 |
| Accelerometer | Endevco | 7254-A-10 | 2549 | 6 | 17-Jan-2013 |
| Isotron Accelerometer | Endevco | 256-10 | 3381 | 6 | 19-Mar-2013 |
| Isotron Accelerometer | Endevco | 256-10 | 3393 | 6 | 7-Mar-2013 |

TU – Traceability Unscheduled



Product Service

SECTION 4

PHOTOGRAPHS

4.1 PHOTOGRAPHS OF EQUIPMENT UNDER TEST (EUT)



Front View (in mounting bracket)



Rear View



Product Service

SECTION 5

ACCREDITATION, DISCLAIMERS AND COPYRIGHT



Product Service

5.1 ACCREDITATION, DISCLAIMERS AND COPYRIGHT



This report relates only to the actual item/items tested.

Our UKAS Accreditation does not cover opinions and interpretations and any expressed are outside the scope of our UKAS Accreditation.

Results of tests not covered by our UKAS Accreditation Schedule are marked NUA
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