



Sebert Trillingstechniek B.V.

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Vibration tests on a TNAML Luminaire



ISO/IEC 17025 Accredited and ISTA® Certified Testing Laboratory

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Order conformation

Technor Benelux B.V. Purchase Order Number T13.2.0307

Present at the tests

Mr. E. Geluk of Technor Benelux B.V.

S2T Quotation

E-mail 02 July 2013

Author / Tester

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1. Introduction

Under contract of Technor Benelux B.V. at Spijk in The Netherlands, vibration tests have been carried out on a TNAML Luminaire. The vibration test was carried out on 21 August 2013. All dynamic tests have been carried out under ISO 17025 accreditation. Technor Benelux B.V. will carry out the final inspection after the complete test sequence. Purpose of this test is to determine if the test item meets the vibration requirements. In accordance with Technor Benelux B.V. an acceptance criteria was defined. No (pre)conditioning was carried out. The test results in this report will be related to the tested test item only.

2. Test procedure and equipment

2.1. General

One test item has been used for the vibration tests, see Table 1 for the details of the test item. During the test the test item was not operational. The test item which arrived on 15 August 2013 was checked before starting the test and no deviations were found.

Table 1A: Test item #1

Type designation	Lighting luminaire
Product number	TNAML 2x36 E
Serial number	T13.00255
Weight	+/- 15 kg
Figure	#1



2.2. Vibration requirements

The following table (Test A) present the test specifications. See Table 2 for the test plan.

Test A: Sine vibration test specifications

Normative document	IEC 60068-2-6:2008 Environmental testing - Part 2-6 Tests – Test Fc: Vibration (sinusoidal)
Test standard	IEC 60068-3-3:1991
Sine vibration profile	4,9 to 50,1Hz 0,75g acceleration (vertical) 4,9 to 50,1Hz 1,5g acceleration (horizontal)
Sweep rate	1 oct/min
Sweep cycles	2 sweeps (1 up and 1 down per direction)
Direction	in three mutually perpendicular directions
Operational during test	No, after the test the functionality needs to be tested

Table 2: Test plan

Step	Test	Direction
1	A	Vertical (Z)
2	A	Horizontal longitudinal (Y)
3	A	Horizontal transversal (X)

2.3 Mounting and orientation of the test items

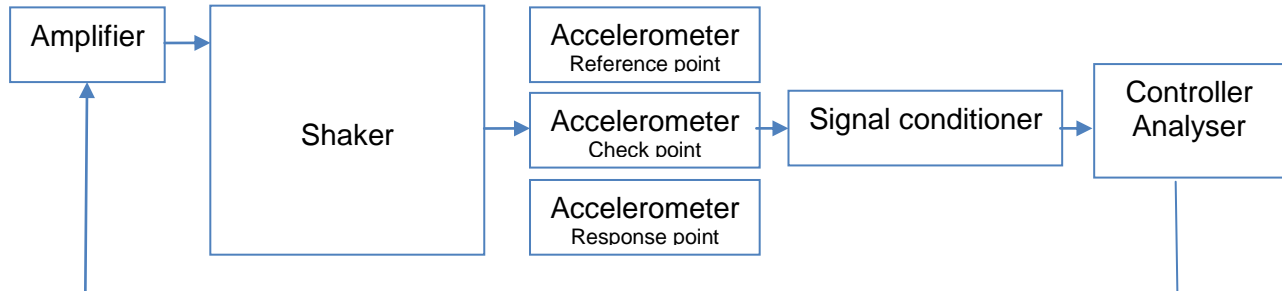
The test item was mounted on the vibration table through its normal points of attachment and in normal orientation with respect to the vertical. The test were carried out in three mutually perpendicular directions, see Figure #2 for de vertical (Z) direction, see Figure #3 for the horizontal longitudinal (Y) direction and see Figure #4 for the horizontal transversal (X) direction.

2.4. Description of the used apparatus and instrumentation

Apparatus and/or instrumentation	Supplier	Model Number	Serial Number	Last / Next date of Calibration, Verification and/or Inspection	
Electric-dynamic shaker	Tira	TV 59355/AIT- 440 TGT Model 48XXL	036/07	25-10-12	25-10-13
ICP Accelerometer (check/cross axis point)	PCB Piezotronics	356B21	90931XYZ	05-09-12	05-09-13
ICP Accelerometer (reference point)	PCB Piezotronics	353B34	106991	24-01-13	24-01-14
Shaker control system	Dactron	Laser	4637789	08-11-12	08-11-13
Signal Conditioner	PCB Piezotronics	482C16	428	30-05-13	30-05-14

Monitoring of the environmental conditions	Novasina	ClimaLog 30	1206059	20-11-12	20-11-14
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2.5. Sketch of the test configuration



2.6. Measurement uncertainty and tolerances

All the measurements were carried out with a signal tolerance includes instrumentation errors lower than 5% according to the standards. The combined standard uncertainty ($k=2$) and the expanded uncertainty ($k=2$) is lower than 10%. For lower vibration frequency ($>1 <10\text{Hz}$), large size and high mass the signal tolerance is lower than 10%. Temperature and relative humidity are not operational factors.





3. Vibration and shock tests

3.1. General

The sine sweep vibration tests were carried out in three mutually perpendicular directions on a shaker.

3.1.1. Test A: Vibration test setup

The vibration acceleration tolerance at the reference point is $\leq 1\text{dB}$ and the check point $\leq 2\text{dB}$. The maximum vibration amplitude at the check points in any axis perpendicular to the specified axis does not exceed 50% of the specified amplitude up to 500 Hz (as described in IEC 60068-2-6:2008 paragraph 4.1.2.1). See Table 3 for the used vibration parameters.

Table 3: Vibration control parameters

System	Parameters
Controller	Closed loop – Automatic Equalization
Max. Test Frequency:	150.00 Hz
Sweep Type:	Logarithmic
Sweep Rate:	1.000000 Oct/Min
Measurement Strategy:	Single Channel
Filter Type:	Proportional
Band Width:	25%
Drive Limit:	10.00 Volts
Abort Latency:	0.30 seconds
Compression Speed Type:	Adaptive
Compression Speed:	Fast

3.1.2 Accelerometers location and orientation

See Table 4 for the location and orientation of the used accelerometers during the tests.

Table 4: Used accelerometers

Test item	Direction	Input channel	Accelerometer Serial number	Location	Figure
#1	X, Y, Z	1	106991	On the vibration table	-
#1	X, Y, Z	2,3,4	90931 (XYZ)	On the vibration table	-



3.2. Test A: Vibration test result

A vibration test in the three mutually perpendicular directions has been carried out, see Table 5 for the summary. See Figure #5 for a typical vibration plot. During the vibration test in Y direction 2 connection bolts came loose see Figure #6, in accordance with Technor Benelux B.V. the bolts have been tightened and further testing continued. No visual damage or functional errors have been found on the test item after the complete test sequence.

Table 5: Vibration test result summary

Test item	Direction	Test time [min]	Remarks
#1	Vertical (Z)	7	Pass
#1	Horizontal longitudinal (Y)	7	Pass, connection bolts came loose.
#1	Horizontal transversal (X)	7	Pass

3.3. Laboratory ambient (during test)

See Figure #7 for the environmental measurements during the test sequence.



4. Conclusion and remarks

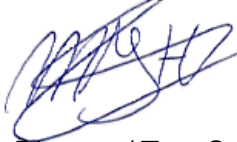
One test item has been subjected to vibration tests according to the normative document:
➤ IEC 60068-2-6:2008 Environmental testing - Part 2-6 Tests – Test Fc: Vibration.

See the following table for the summary of the test results:

Test A: Vibration test	During the vibration test in Y direction 2 connection bolts came loose, in accordance with Technor Benelux B.V. the bolts have been tightened and further testing continued. No visual damage or functional errors have been found on the test item after the complete test sequence.
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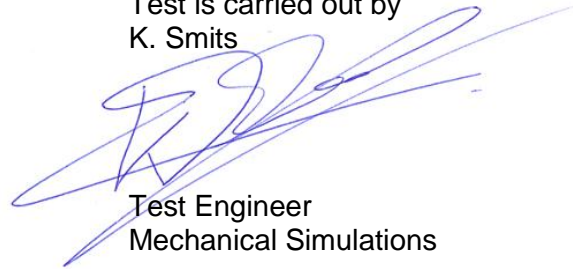
Technor Benelux B.V. carried out the final inspection on the test item after the completed test sequence, the TL and LED lighting were still functional.

Approved by
M.J.H. Magendans



Director / Test Specialist
Mechanical Simulations

Test is carried out by
K. Smits



Test Engineer
Mechanical Simulations



Figures

Figure 1: Test item

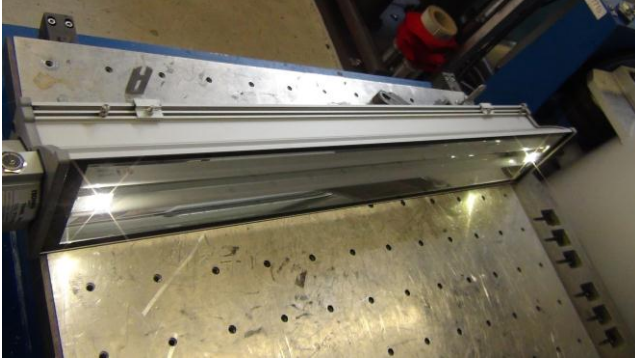


Figure 2: Test setup Z direction

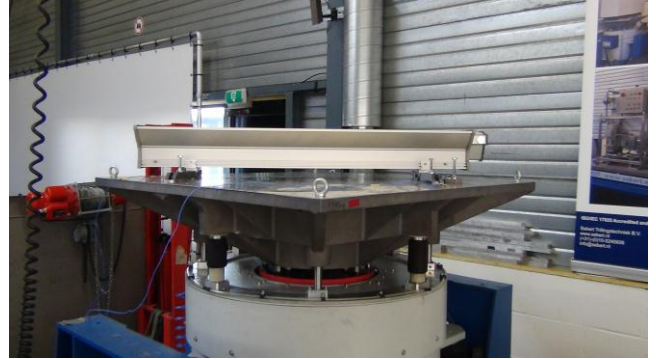


Figure 3: Test setup Y direction



Figure 4: Test setup X direction



Figure 5: Test A vibration plot

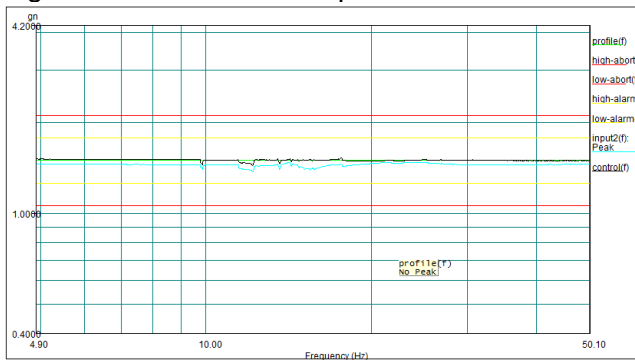


Figure 6: Test A test result

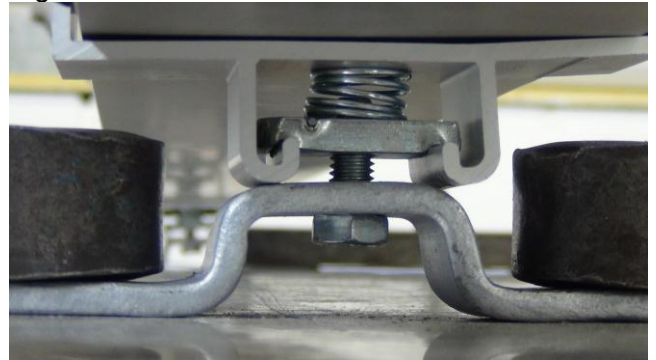
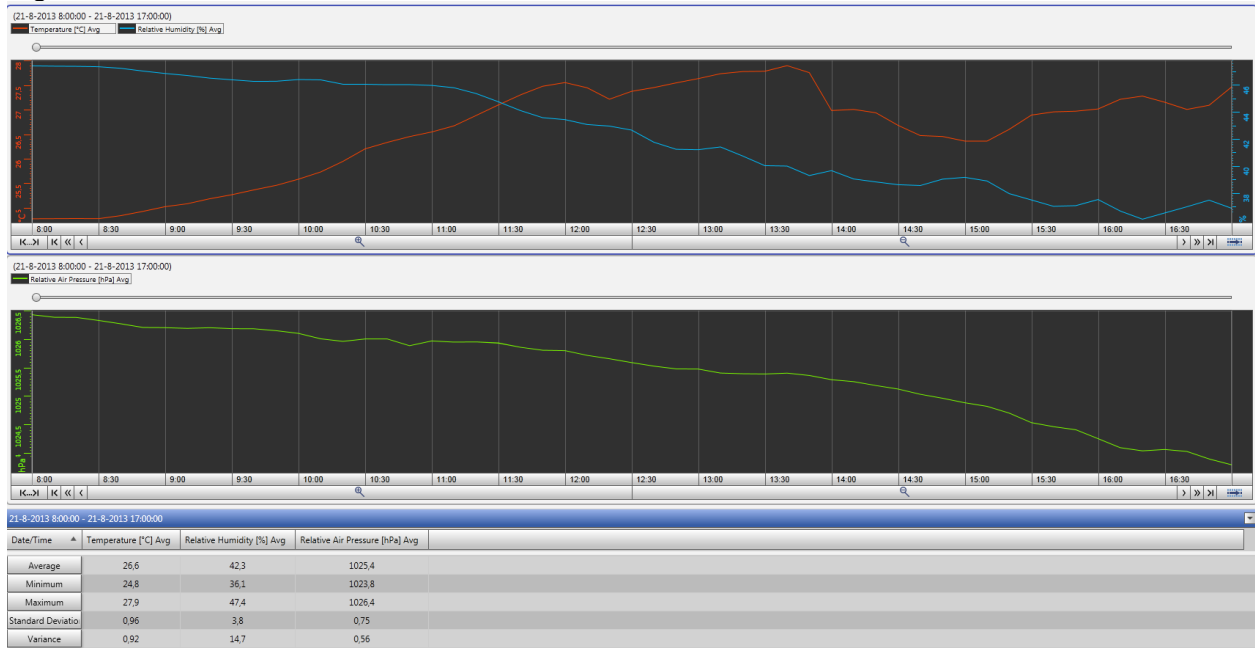


Figure 7: Environmental measurement





Abbreviations

Acc	Acceleration
ASD	Acceleration Spectral Density
AvC	Average Control
dB	decibel, sound level
DOF	Degrees of Freedom
Drive	Voltage output of the controller used to drive the shaker
DUT	Device under test
Dwell	Endurance test on 'fixed' frequency
Fn	Natural frequency
g	Acceleration due to gravity (equal to 9,81 m/s ²)
Hz	Hertz
kg	Kilogram
Manuf	Manufacturer
ms	Milliseconds, nominal duration
N	Newton (force)
Oct/min.	Sweep rate
Oper	Operational
OS	Operational Shock
Pa	Pressure
PK	Peak
PK-PK	Peak to Peak
PSD	Power Spectral Density
Q	Quality, Sharpness measure of a resonance
Res	Resonance
RS	Resonance Survey
RMS	Root Mean Square
Seq	Sequence
S/N	Serial Number
SRS	Shock Response Spectrum
Sweep	One sweep up or down
Sweep cycle	One sweep up <u>and</u> down
TS	Test Sequence
V	Voltage





Distribution

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<u>Sebert Trillingstechniek B.V.</u> Mr. M.J.H. Magendans	1

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