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REPORT NO. 102320670CRT-001g

SOUND OUTPUT MEASUREMENTS ON SIX INVERTER GENERATOR SAMPLES

RENDERED TO

GENERAC POWER SYSTEMS, INC.
S45 W29290 HIGHWAY 59
WAUKESHA, WI 53189

INTRODUCTION

This report gives the results of sound output measurements of six inverter generator samples. The Generac samples were production samples selected from the production line by a representative of Intertek, sealed with selection tape, and sent to Intertek. They were received at the laboratories on October 15, 2015. The Honda samples were purchased by Intertek through a known retailer and were received at the laboratories on October 16, 2015. The samples appeared to be in new unused condition.

AUTHORIZATION

Signed Intertek Quotation No. Qu-00647368

INTERTEK SUMMARY

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TEST METHOD

The laboratory method used in conducting these tests is in accordance with ISO 9614-2, “Acoustics - Determination of Sound Power Levels of Noise Sources Using Sound Intensity - Part 2: Measurement by Scanning”

Data was obtained on a 01dB Symphonie Digital Frequency Analyzer and GRAS sound intensity probe. The testing was completed outdoors in a large open field with a cut grass ground surface. The nearest building was 60 feet away and was not parallel to any side of the test being conducted.

Load banks were spaced far enough away to not contribute to the noise generated by the generator. The loading equipment consisted of one resistive load banks monitored with a Yokogawa YT210 power analyzer. The temperature and humidity was measured with a digital thermohygrometer.

TEST METHOD (Continued)

The samples were scanned via the parallel piped method with a scan surface on each side and the top of the test sample at a distance of 0.5 meters. The testing was conducted on October 20, 2015 and October 21, 2015. The front of the sample is defined as the side with the electrical connections.

EQUIPMENT LIST

Description	Serial Number	Calibration Date	Calibration Due Date
01dB Digital Frequency Analyzer	1817	5/1/2015	5/1/2016
GRAS Type 41AI Intensity Microphone Set	49941/49942	4/30/2015	4/30/2016
B&K Type 4231 calibrator	2130586	3/30/2015	3/30/2016
Power Analyzer YT210	2534GA961	11/24/2014	11/24/2015
Extech Thermohygrometer	E532	10/10/2015	10/10/2016

PRECISON

The estimated upper limits of the standard deviations of reproducibility of sound power levels determined in accordance with the standard are given below:

Band width	Midband frequencies (Hz)	Estimated upper values of standard deviation reproducibility (dB)
One-third octave	50 to 160 200 to 315 400 to 5000 6300 to 10000	3.0 2.0 1.5 2.5
Octave	63 - 125 250 500 to 4000 8000	3.0 2.0 1.5 2.5
A-weighted		1.5[1*]

[1]Applicable to a source which emits noise with a relatively "flat" spectrum in the frequency range 63 Hz to 10000 Hz.

*During a round robin test with the intensity probe measurements done within very close time frame and at similar conditions showed an A-Weighted repeatability of plus or minus 0.3 dBA when calculated from 50 Hz through 10000 Hz on 10 samples.

DESCRIPTION OF TEST SPECIMENS

The test specimens consisted of 6 generator samples. The Generac samples were identified with model number iQ2000, the serial numbers are listed in the table below. These samples were identified as production test units. The Honda test samples were identified with model number EU2000i, the serial numbers are listed in the table below. The samples were labelled a through f.

PARAMETERS

The following parameters are controlled

Value	Description	Units	Method	MU
Power	Load Bank	Watt	Load Bank	0.5%

The following parameters are monitored

Value	Description	Units	Method	MU
Temperature	Dry Bulb Air Temperature	Deg F	Thermohygrometer	2%
Relative Humidity	Humidity	% RH	Thermohygrometer	3%
Voltage	Line Voltage	Vac	Power Analyzer	0.2%
Sound	Sound Pressure Level (re: 20 micropascals)	decibels	01dB Analyzer	See Table

SAMPLE ACQUISITION

Samples acquired by Intertek and supplied by the client:

Sample #	Description	Serial #	Purchase Location	Date	Condition
A	Honda Generator EU2000i	EACT-1361093	Known Retailer	10/16/2015	New
B	Honda Generator EU2000i	EACT-1361095	Known Retailer	10/16/2015	New
C	Honda Generator EU2000i	EACT-1361094	Known Retailer	10/16/2015	New
D	Generac Generator iQ2000 / 006660	9948820	Selected At Client Production Line	10/15/2015	New
E	Generac Generator iQ2000 / 006660	9937649	Selected At Client Production Line	10/15/2015	New
F	Generac Generator iQ2000 / 006660	9948858	Selected At Client Production Line	10/15/2015	New

Samples D through F were production samples selected from the production line by a representative of Intertek, sealed with selection tape, and sent to Intertek.

HYPOTHESIS

Sound testing will be conducted and the results presented per the requirements of the test standard. If the samples are statistically significantly different then it will be declared in the final results at the 50% load condition from the face of the test sample only. If the samples are not statistically significantly different then that will be the stated result. The load condition will be set via a constant resistance load provided by a load bank.

PHOTOGRAPHS OF TEST SAMPLES

SAMPLE A

SAMPLE B

SAMPLE C

PHOTOGRAPHS OF TEST SAMPLES

SAMPLE D

SAMPLE E

SAMPLE F

RESULTS OF TESTS

Sound Power Level

		Front
Sample ID	Test Condition	Sound Power Level, dBA (re: 10 picoWatt)
A	50% - 18.9 Ohms	70.6
B	50% - 19.1 Ohms	70.8
C	50% - 19.1 Ohms	70.8
D	50% - 19.1 Ohms	69.3
E	50% - 19.1 Ohms	69.7
F	50% - 18.9 Ohms	70.0

Sound Pressure Level at 9 feet

		Front
Sample ID	Test Condition	Sound Pressure Level, dBA (re: 20 µPa)
A	50% - 18.9 Ohms	53.8
B	50% - 19.1 Ohms	54.0
C	50% - 19.1 Ohms	54.0
D	50% - 19.1 Ohms	52.6
E	50% - 19.1 Ohms	53.0
F	50% - 18.9 Ohms	53.2

Sound Pressure Level at 23 feet

		Front
Sample ID	Test Condition	Sound Pressure Level, dBA (re: 20 µPa)
A	50% - 18.9 Ohms	45.7
B	50% - 19.1 Ohms	45.8
C	50% - 19.1 Ohms	45.9
D	50% - 19.1 Ohms	44.4
E	50% - 19.1 Ohms	44.8
F	50% - 18.9 Ohms	45.1

SAMPLE A – Specific Test Conditions

Sample ID	Test Condition	Measured Load (Watt)	Output Voltage
A	50% - 18.9 Ohms	801	123.0
B	50% - 19.1 Ohms	791	122.9
C	50% - 19.1 Ohms	790	122.8
D	50% - 19.1 Ohms	744	119.2
E	50% - 19.1 Ohms	747	119.4
F	50% - 18.9 Ohms	745	118.8

Sound pressure levels calculated using formula 25 from the ASHRAE handbook 2013 with an estimated Q factor of 2 representing a free field over a reflecting plane condition.

ANALYSIS OF RESULTS AT 50% LOAD CONDITION

Sample ID/Group #	dBA @ 50% Load*	Average dBA of Group*	Standard Deviation
A / 1	70.6	70.7	0.1
B / 1	70.8		
C / 1	70.8		
D / 2	69.3	69.7	0.4
E / 2	69.7		
F / 2	70.0		

*Sound Power levels in dBA referenced to 10^{-12} W.

REMARKS

1. Ambient Temperature: 60 – 64 °F
2. Relative Humidity: 38 – 40%

CONCLUSION

The hypothesis for this testing states that if a particular unit is statistically significantly different it will be declared in the results. The finding of the measurements was that at a 50% load condition measuring from the face of the test sample the Generac randomly selected sample group (D, E, and F) measured statistically quieter versus the Honda randomly selected sample group (A, B, and C).

Statement 1:

$$\overline{(AverageGroup1 - AverageGroup2)} > (2 * StandardDeviationGroup1 + 2 * StandardDeviationGroup2)$$

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Attachments: None