AN EXPERIMENTAL ASSESSMENT OF THE CSA STANDARD ON 'MEASUREMENT AND RATING OF THE NOISE OUTPUT OF CONSUMER APPLIANCES'

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ABSTRACT

The noise output of five small sound sources has been measured using three different methods suggested by the CSA standard Z107.71-M1981. Results indicate they can produce consistent answers.

RÉSUMÉ

Le bruit produit par cinq sources sonores a été mesuré selon trois méthodes recommandées par la norme Z107.71-M1981 de l'Association canadienne de normalisation. Les données obtenues indiquent que ces méthodes fournissent des résultats sensiblement uniformes.

INTRODUCTION

This work was undertaken to provide additional experimental support to the CSA standard on 'Measurement and Rating of the Noise Output of Consumer Appliances.' Four small appliances and a standard ILG source were tested according to the three different methods suggested by the CSA standard. Although the noise output of some of the sources had been measured before,[1] they were retested here to form a complete set. No attempt has been made to compare the present results with those of Ref. 1 since the operating conditions of the appliances might not have been the same.

SOURCES

The sources and their operating conditions chosen for the present experiment are:

1) a standard ILG source;
2) a small blower operated at maximum speed;
3) a heat gun set in the 'cold' position with the air entry port set at maximum opening;
4) a fixed speed hand drill; and
5) a blender filled with 680 g (24 oz) of water and operated at three different speeds, No. 1 (slowest), No. 7 (medium), and No. 14 (maximum).

Although these sources represent only a small cross section of consumer appliances, it is hoped that their characteristics are different enough to provide a reasonably good test of the three methods of the standard. The one-third octave power spectra of these sources were measured in a reverberation room and are presented in Fig. 1.

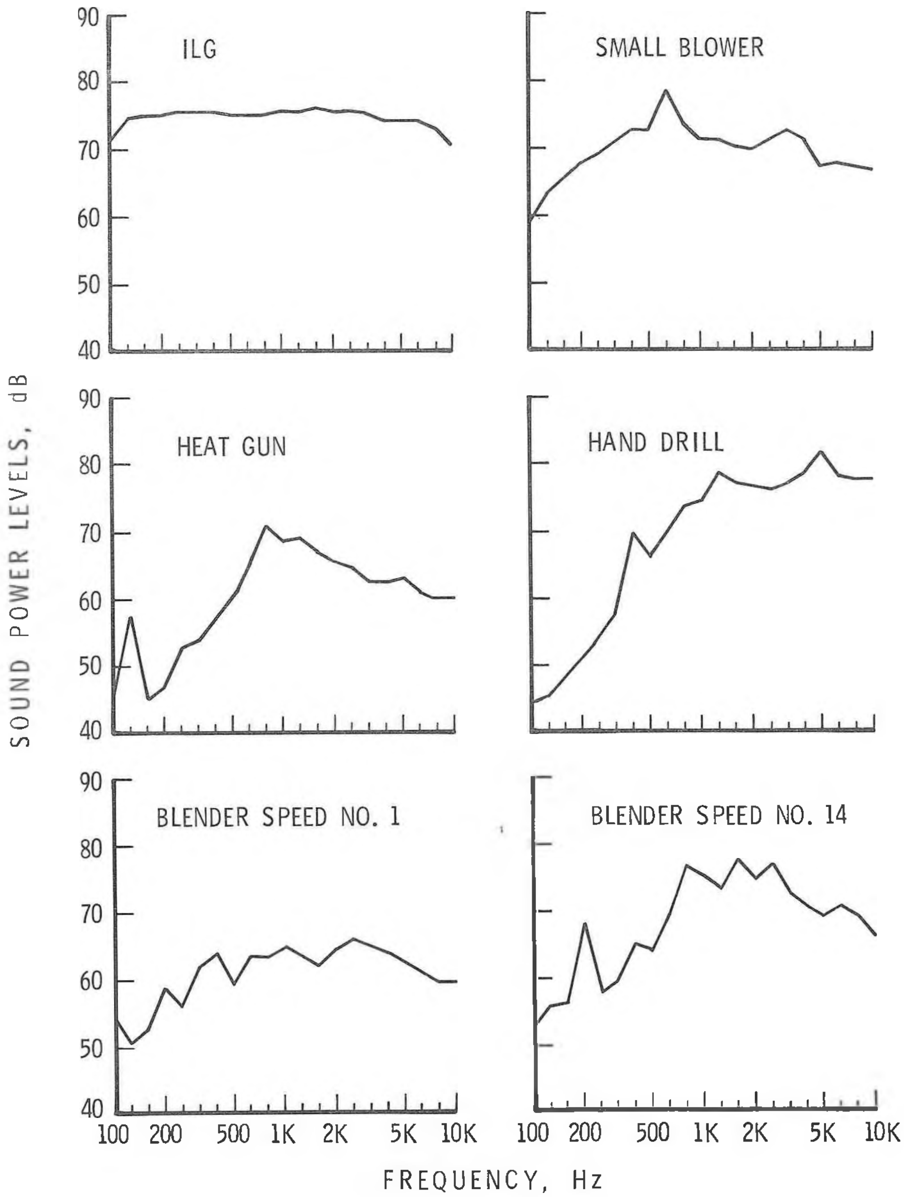

Figure 1. One-third octave band sound power levels of the different sources used in the experiment.

METHODS

The noise output for each of the sources listed above was measured with the source sitting on a hard surface using the following methods.

(1) Reverberation Room Method:

The measurements were conducted according to ANSI Standard S1.31-1980 in a reverberation chamber with a nominal volume of 255 m^3 and dimensions of $8.0 \times 6.5 \times 4.9$ m. The room is equipped with fixed diffusers and a rotating vane. It has automatic environmental controls and is generally maintained at 21°C and 55% relative humidity.

The sound field was sampled by nine microphones located randomly in the room and the sources were tested at three different locations on the floor. The basic data obtained by this test were sound power levels for a series of one-third octave frequency bands from 100 to 10,000 Hz. These were then added with proper A-weighting corrections to produce the A-weighted sound power levels. A more detailed description of the instrumentation used can be found in Ref. 2.

(2) Free Field Method:

The measurements were made outdoors in an open field with the nearest building at least 100 m away. The reflecting floor was a painted 2.4×2.4 m wood panel with a 38 mm thickness. Two measuring radii of 0.75 and 1 m were used. Except for the ILG source and the heat gun, the four recommended measuring locations were found to be quite adequate. The A-weighted sound pressure levels were measured directly with a B&K Type 2218 integrating sound level meter equipped with a Type 4165 microphone and a windscreen; this combination offers a flat frequency response for free field measurement at 0° angle of incidence. The integration time used was 3.6 s. The instrument was calibrated with a B&K Type 4230 calibrator both before and after each test.

(3) Partially Absorptive Room Method:

For this case, a 122 m^3 reverberation room was converted into a partially absorptive room by adding absorption to meet the requirement that A/R^2 be greater than 20. R is the measurement radius and A is the sound absorption of the test room determined from reverberation time measurements. Two values of A, 19.1 and 27.8 metric sabins, were used. As in method (2), two measuring radii were used with the same positions around the sources. The A-weighted sound pressure levels were also taken with the B&K Type 2218 sound level meter.

RESULTS AND DISCUSSION

For comparison purposes, the results obtained by the three different methods have been converted to sound level ratings for indoor usage as specified in CSA Z107.71. These are presented in Table 1.

Although the reverberation room method tends to give higher values for most of the sources tested, the differences are not large and cast no serious doubts on the validity of the three methods used. It is hoped that this excercise will give manufacturers confidence in adopting any one of these methods for measuring the noise output and rating their products.

TABLE 1
Comparison of Sound Level Ratings (dBA) of Different Sources
Obtained by the Three Methods

Noise Sources	Reverberation Room	Free-Field Measurements		Partially Absorptive Room			
				A = 19.1		A = 27.8	
		R=.75	R=1.0	R=.75	R=1.0	R=.75	R=1.0
ILG	86.5	87.3	87.2	86.5	86.2	86.6	86.5
Small Blower	83.0	82.2	82.3	82.8	82.9	82.7	82.9
Heat Gun	77.0	77.5	77.3	76.6	76.5	77.0	77.4
Hand Drill	89.0	87.5	88.2	88.4	88.3	88.2	88.1
Blender Speed #1	75.5	73.5	73.4	73.0	73.6	74.5	74.0
Blender Speed #7	81.5	80.8	81.0	79.8	79.9	79.3	79.0
Blender Speed #14	85.5	84.9	84.9	84.3	84.7	84.8	84.3

REFERENCES

(1) T.D. Northwood and W.T. Chu, "Measurement of Sound Emission of Small Sources in Reverberant and Anechoic Environments," presented at the Canadian Acoustical Association Annual Meeting at Windsor, Ontario, 24-26 October 1979.

(2) W.T. Chu, "Reverberation Room Qualification Studies at the National Research Council of Canada," Building Research Note No. 203, Division of Building Research, National Research Council Canada, May 1983.