



The Esco Group of Companies

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**Sound Spectrum at 1/3 octave frequency band on the Labculture® Class II
Type A2 Biohazard Safety Cabinets**

Purpose of experiment:

This test ensures that the alarm of the cabinet is loud enough so that when activated, it can be heard by the operator whenever the blower is on or off. This safety feature is enforced by the TUV, from Germany, which states that the alarm noise must exceed the cabinet base noise level (that is the noise level recorded when the blower is operating) by a minimum of 13 dB for at least one 1/3 octave frequency band.

Experiment Method:

Instruments used and details of Instruments used: (see the document at the bottom of this page)

Procedure:

The sound level meter is positioned at a distance of 1 m from the front edge of the cabinet and 1 m above the floor when the cabinet is mounted on a support stand, and the readings are taken at 20 cm offset from the vertical centerline of the cabinet. This is to simulate the human ear location of the operator when the latter is working at the center of the cabinet

Results:

After running the test, the data (*) was transferred to a computer and is as followed:

(*) *Note: Part of the data has been slightly edited so that it is more comprehensible*

QUEST TECHNOLOGIES
1900 PRECISION INTEGRATING/LOGGING SOUND LEVEL METER

Unit Version Number: 02.4 Serial Number: CCC120002

Name Yong Ching Kevin

Work Area Training Room (No sound insulation used)

Comments Experiment was performed at a motor voltage slightly above the nominal voltage

Meter Calibration: 114.0dB 18-DEC-03 @ 09:10:20

Calibrator:
Serial Number QOC100012 Calibration Date 19 DEC 03

Measuring Parameters:
Range 20- 80dB Weighting A Time Constant SLOW
Threshold OFF Exchange Rate 3dB Peak Weighting A



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Alarm OFF and Blower ON

Filter Summary: Model OB-300 1/3 Octave Filter Set - Serial No. HVC 120006

#	Freq(Hz)	LEQ	LMAX	SEL	Start-time	Run-time	OL-%
1	1000	54.4	54.8	58.1	10:16:33	0:00:05	0.00%
2	1250	53.3	53.8	58.3	10:16:41	0:00:03	0.00%
3	1600	54.6	55.1	59.6	10:16:46	0:00:03	0.00%
4	2000	53.1	53.4	58.1	10:16:52	0:00:03	0.00%
5	2500	53.1	53.3	58.1	10:16:57	0:00:03	0.00%
7	4000	48.7	49.0	53.6	10:17:08	0:00:03	0.00%
6	3150	51.1	51.5	56.1	10:17:03	0:00:03	0.00%
8	5000	44.1	44.5	49.0	10:17:14	0:00:03	0.00%
9	6300	38.6	38.9	43.5	10:17:19	0:00:03	0.00%
12	12500	20.1	20.9	25.1	10:17:36	0:00:03	0.00%
10	8000	32.4	33.0	37.4	10:17:25	0:00:03	0.00%
11	10000	26.9	27.3	31.9	10:17:30	0:00:03	0.00%
13	16000	12.7	14.0	17.7	10:17:41	0:00:03	0.00%
14	20000	11.6	11.6	16.6	10:17:47	0:00:03	0.00%
15	12.5	11.7	13.0	16.7	10:17:52	0:00:03	0.00%
16	16	11.6	11.6	16.6	10:17:58	0:00:03	0.00%
17	20	12.2	13.5	17.2	10:17:04	0:00:03	0.00%
18	25	15.2	16.1	20.1	10:18:09	0:00:03	0.00%
19	31.5	16.0	17.2	21.0	10:18:15	0:00:03	0.00%
20	40	21.1	22.1	26.1	10:18:20	0:00:03	2.00%
21	50	26.1	27.0	31.1	10:18:26	0:00:03	0.00%
22	63	36.6	37.6	41.5	10:18:31	0:00:03	0.00%
23	80	37.8	38.6	42.7	10:18:37	0:00:03	0.00%
24	100	44.2	45.3	49.1	10:18:42	0:00:03	0.00%
25	125	42.1	43.1	47.1	10:18:48	0:00:03	0.00%
26	160	41.2	41.8	46.2	10:18:53	0:00:03	0.00%
27	200	47.2	48.0	52.1	10:18:59	0:00:03	0.00%
28	250	48.3	49.0	53.3	10:19:04	0:00:03	0.00%
29	315	51.3	52.2	56.3	10:19:10	0:00:03	0.00%
30	400	53.1	53.6	58.0	10:19:15	0:00:03	7.50%
31	500	53.8	54.3	58.7	10:19:21	0:00:03	0.00%
32	630	54.6	55.1	59.6	10:19:26	0:00:03	0.00%
33	800	55.7	56.0	60.6	10:19:32	0:00:03	0.00%

Alarm ON and Blower ON

43	1000	55.6	55.9	60.5	10:22:39	0:00:03	94.50%
44	1250	53.9	54.3	58.9	10:22:44	0:00:03	99.00%
45	1600	54.8	55.2	59.8	10:22:50	0:00:03	93.50%
46	2000	55.5	56.0	60.5	10:22:55	0:00:03	50.50%
47	2500	56.0	56.5	60.9	10:23:01	0:00:03	43.50%
48	3150	52.8	53.1	57.7	10:23:06	0:00:03	18.00%
49	4000	65.4	66.0	70.3	10:23:12	0:00:03	35.00%
50	5000	64.8	65.4	69.7	10:23:17	0:00:03	27.00%
51	6300	51.1	55.5	56.1	10:23:23	0:00:03	9.50%
52	8000	36.4	38.5	41.4	10:23:28	0:00:03	21.00%
53	10000	29.4	29.9	34.4	10:23:34	0:00:03	1.00%
54	12500	22.5	23.2	27.4	10:23:39	0:00:03	6.00%
55	16000	16.0	16.8	20.9	10:23:45	0:00:03	1.50%
56	20000	11.6	11.6	16.6	10:23:50	0:00:03	5.00%
57	12.5	11.6	11.6	16.6	10:23:56	0:00:03	0.00%
58	16	11.6	11.6	16.6	10:24:01	0:00:03	0.99%
59	20	12.1	13.7	17.1	10:24:07	0:00:03	0.99%
60	25	16.6	17.9	21.6	10:24:12	0:00:03	5.47%



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61	31.5	18.8	20.9	23.8	10:24:18	0:00:03	0.00%
62	40	23.5	25.2	28.5	10:24:23	0:00:03	2.00%
63	50	27.3	28.5	32.2	10:24:29	0:00:03	2.50%
64	63	35.9	36.9	40.9	10:24:34	0:00:03	0.00%
65	80	39.7	40.6	44.7	10:24:40	0:00:03	0.00%
66	100	46.4	47.6	51.3	10:24:45	0:00:03	0.00%
67	125	44.9	45.8	49.9	10:24:51	0:00:03	9.00%
68	160	42.2	43.2	47.1	10:24:56	0:00:03	4.00%
69	200	47.5	48.6	52.5	10:25:02	0:00:03	4.00%
70	250	50.2	50.9	55.1	10:25:07	0:00:03	1.00%
71	315	50.9	51.5	55.8	10:25:13	0:00:03	2.50%
72	400	53.1	53.8	58.0	10:25:18	0:00:03	7.00%
73	500	54.8	55.3	59.8	10:25:24	0:00:03	2.00%
74	630	56.3	56.6	61.2	10:25:29	0:00:03	0.00%
75	800	56.6	57.5	61.6	10:25:35	0:00:03	2.50%

Calculations:

From the data downloaded to the computer from the sound level meter, the values were then logged in a calculation table (see below) through which the difference between the alarm noise and the cabinet base noise level can be directly obtained. From the table, the first column represents the different frequencies of the 1/3 octave frequency band at which the sound level meter will sample the noise. The second and third columns show the different noise levels obtained at the corresponding 1/3 octave frequency bands when the blower is operating and when the alarm is activated on top of the blower noise respectively. Finally, the last column shows the difference between the alarm noise and the cabinet base noise level. The values are obtained through a series of calculations. Part of the table is shown below:

Frequency [Hz]	Operated/ON [dB]	Alarm [dB]	Intermediate value	Monitoring threshold	Difference
1,000	54.4	55.6	-2.5	54.4	1.2
1,250	53.3	53.9	51.9	53.3	0.6
1,600	54.6	54.8	50.8	54.6	0.2
2,000	53.1	55.5	52.1	53.1	2.4
2,500	53.1	56.0	50.6	53.1	2.9
3,150	51.1	52.8	50.6	51.1	1.7
4,000	48.7	65.4	48.6	48.7	16.7
5,000	44.1	64.8	46.2	46.2	18.6
6300	38.6	51.1	43.7	43.7	7.4
8000	32.4	36.4	41.2	41.2	-4.8
10.0K	26.9	29.4	38.7	38.7	-9.3

Conclusion:

At 4000 and 5000 Hz, the alarm is 16.7 and 18.6 dB respectively above the cabinet base noise level (ON). This shows that our cabinet successfully passes the TUV alarm requirement as our alarm noise level is more than 13 dB above the cabinet base noise level during normal operation.