

Università degli Studi di Padova – Dipartimento di Ingegneria Industriale

Dipartimento di Tecnica e Gestione dei Sistemi Industriali

Corso di Laurea in Ingegneria dell'Energia

Relazione per la prova finale
***«Misure intensimetriche della potenza sonora
emessa da un bruciatore di media potenza»***

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Vicenza, 18/03/2024

- Illustrare le nozioni di base della misura intensimetrica e del funzionamento della sonda intensimetrica
- Analizzare la norma ISO 9614-1:2009
- Applicare la norma ad un caso reale eseguendo una misura su un bruciatore

Intensità sonora: $I = \overline{p(t) v(t)}$

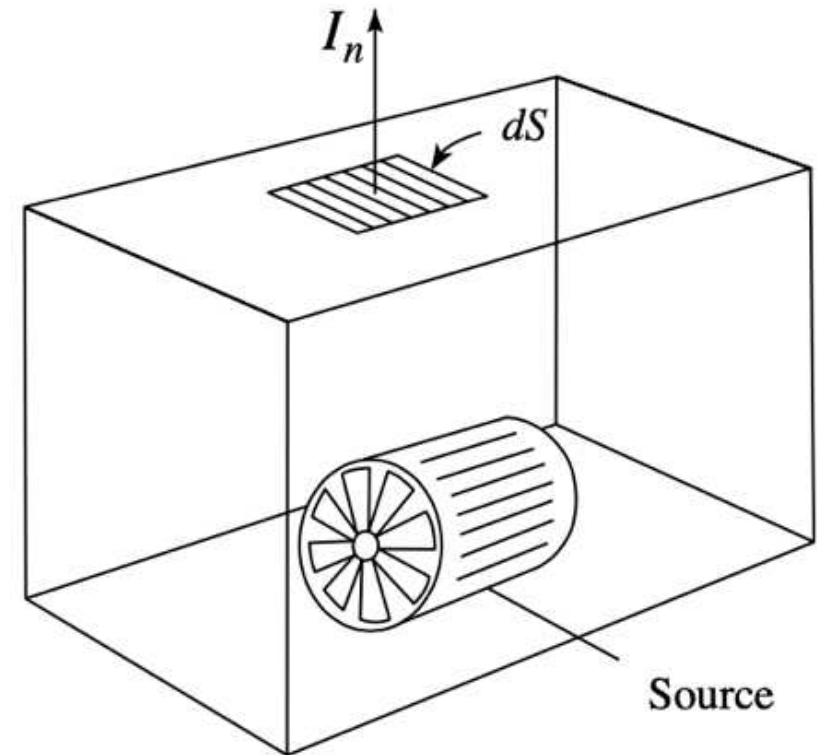
$$v_r = -\frac{1}{\rho} \int \frac{\partial p}{\partial r} (t) dt$$

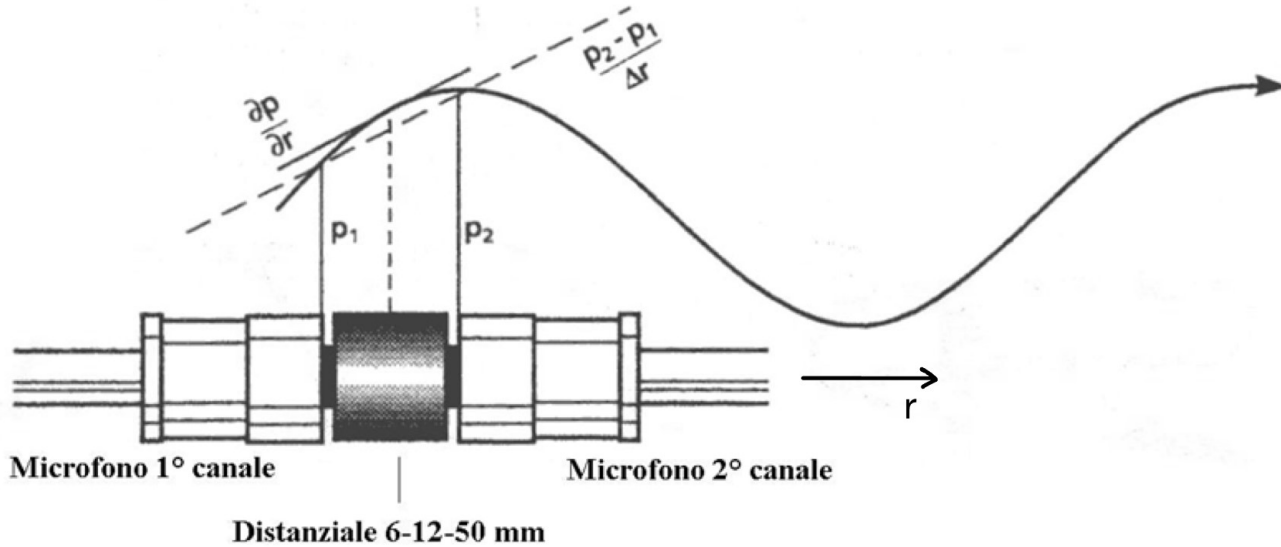
Potenza sonora: $W = \int_S \mathbf{I} \cdot \mathbf{n} ds$



$$W = \sum_i I_i S_i$$

I_i è la componente normale dell'intensità
sonora mediata sull' i -esima sezione S_i





$$v_r \cong -\frac{1}{\rho} \int_T \frac{p_1 - p_2}{\Delta r} dt$$

$$p = \frac{p_1 + p_2}{2}$$

$$I_r = p v_r$$

Indice pressione-intensità:

$$L_{pI} = L_p - L_I = -10 \log_{10} \left(\frac{\lambda}{\Delta r \cos \theta} \frac{\phi}{360} \right) + 10 \log_{10} \left(\frac{\rho c}{400} \right)$$

Indice pressione-intensità residua:

$$\delta_{pI,r} = L_p - L_{I,r}$$

Capacità dinamica:

$$L_d = \delta_{pI,r} - k > L_{pI} \quad \text{dove } k \text{ vale } 7 \text{ o } 10 \text{ dB}$$

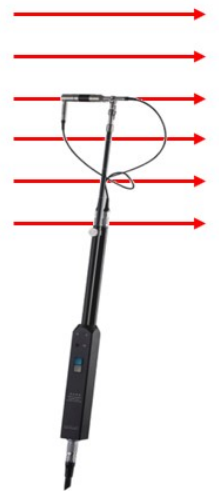
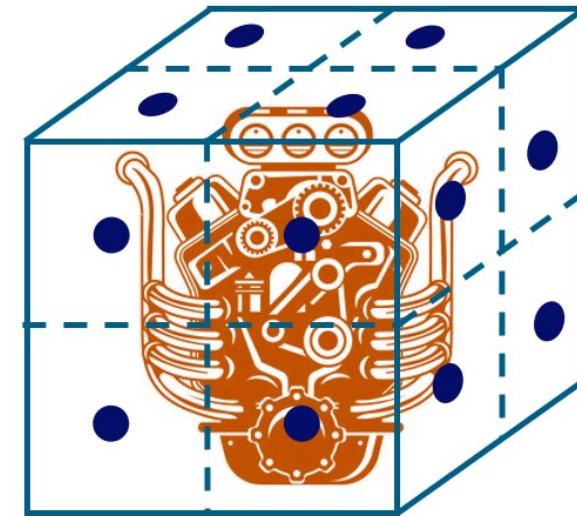
Rispetto ad una misura di tipo tradizionale (misura della pressione sonora), la misura intensimetrica ha importanti vantaggi, dovuti a minori restrizioni su:

- Tipo di ambiente:

le misure possono essere effettuate sul campo

- Campo sonoro:

il rumore di fondo non ha molta influenza sulla misura



Il **valore dell'intensità sonora entrante** da un lato della superficie di misura viene **annullato** dal **valore dell'intensità sonora uscente** dal lato opposto.

Superficie di misura:

Distanza tra sorgente e superficie: almeno 0,5 m

La superficie va divisa in almeno 10 sotto-superfici di area massima 1 m²

- Se il rumore esterno è trascurabile e la superficie è $> 50 \text{ m}^2$:
distribuire uniformemente 50 sotto-superfici
- Se il rumore esterno non è trascurabile e sono necessarie più di 50 sotto-superfici:
aumentare l'area massima di ciascuna sotto-superficie a 2 m²

Indicatori del campo sonoro:

**Indicatore della variabilità
temporale del campo sonoro:**

$$F_1 = \frac{1}{\bar{I}_n} \sqrt{\frac{1}{M-1} \sum_{k=1}^M (I_{nk} - \bar{I}_n)^2} \quad \text{con} \quad \bar{I}_n = \frac{1}{M} \sum_{k=1}^M I_{nk}$$

**Indicatore superficiale
pressione-intensità :**

$$F_2 = \bar{L}_p - \overline{L_{|I_n|}} \quad \text{con} \quad \bar{L}_p = 10 \log \left(\frac{1}{N} \sum_{i=1}^N 10^{0,1L_{pi}} \right) \quad \text{e} \quad \overline{L_{|I_n|}} = 10 \log \left(\frac{1}{N} \sum_{i=1}^N \frac{|I_{ni}|}{I_0} \right)$$

**Indicatore di potenza
parziale negativa :**

$$F_3 = \bar{L}_p - \overline{L_{I_n}} \quad \text{con} \quad \overline{L_{I_n}} = 10 \log \left| \frac{1}{N} \sum_{i=1}^N \frac{I_{ni}}{I_0} \right|$$

**Indicatore della non
uniformità del campo sonoro :**

$$F_4 = \frac{1}{\bar{I}_n} \sqrt{\frac{1}{N-1} \sum_{i=1}^N (I_{ni} - \bar{I}_n)^2} \quad \text{con} \quad \bar{I}_n = \frac{1}{N} \sum_{i=1}^N I_{ni}$$

Verifica accuratezza della misura:

$$F_1 < 0,6 \longrightarrow L_d > F_2 \longrightarrow (F_3 - F_2) \leq 3 \text{ dB} \longrightarrow N > CF_4^2$$

Dove L_d è calcolato dalla formula vista in precedenza e C è un fattore tabulato.

Se i valori misurati verificano queste condizioni, è possibile calcolare il **livello di potenza sonora**:

$$L_W = 10 \log \sum_{i=1}^N \frac{P_i}{P_0}$$

con $P_i = I_{ni} S_i$ e $P_0 = 10^{-12} \text{ W}$

Table 2 — Uncertainty in the determination of sound power levels

Octave band centre frequencies Hz	One-third-octave band centre frequencies Hz	Standard deviations, s 1)		
		Precision (grade 1) dB	Engineering (grade 2) dB	Survey (grade 3) dB
63 to 125	50 to 160	2	3	
250 to 500	200 to 630	1,5	2	
1 000 to 4 000	800 to 5 000	1	1,5	
	6 300	2	2,5	
A-weighted ²⁾				4 ³⁾

1) The true value of the sound power level is to be expected with a certainty of 95 % in the range of $\pm 2s$ about the measured value.

2) 63 Hz to 4 kHz or 50 Hz to 6,3 kHz.

3) In view of the wide variation of equipment for which the standards may be applied, the value given is only tentative.

Se i valori misurati non verificano i criteri di accuratezza, la norma prevede una serie di azioni correttive:

Criterio	Codice iniziativa (vedere figura B.1)	Iniziativa
$F_1 > 0,6$	e	Agire in modo da ridurre la variabilità temporale dell'intensità residua o misurare in periodi di minore variabilità o aumentare il periodo di misurazione in ogni posizione (se possibile).
$F_2 > L_d$ o $(F_3 - F_2) > 3$ dB	a	In presenza di elevato rumore residuo e/o forte riverberazione, ridurre la distanza media tra la superficie di misurazione e la sorgente ad un valore medio minimo di 0,25 m. In assenza di elevato rumore residuo e/o forte riverberazione, aumentare la distanza media misurata fino a 1 m.
	oppure	
Il criterio 2 non è soddisfatto e 1 dB $\leq (F_3 - F_2) \leq 3$ dB	b	Proteggere la superficie di misurazione dalle sorgenti di rumore residuo o cercare di ridurre la riflessione del suono verso la sorgente.
Il criterio 2 non è soddisfatto e $(F_3 - F_2) \leq 1$ dB e il procedimento in 8.3.2 non è applicabile o non è selezionato	c	Aumentare la densità delle posizioni di misurazione in modo uniforme per soddisfare il criterio 2.
	d	Aumentare la distanza media tra la superficie di misurazione e la sorgente usando lo stesso numero di posizioni di misurazione o aumentare il numero di posizioni di misurazione sulla superficie stessa.

La misura è stata realizzata presso la F.B.R. Bruciatori S.r.l. di Angiari (VR), nel laboratorio dell'azienda.

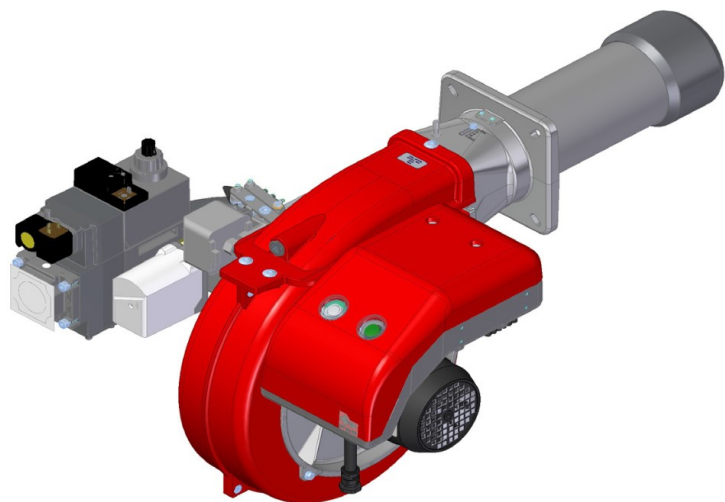
Modello analizzato: GAS XP60/MCE (TC) EVO

Combustibile: Gas metano

Potenza termica: 107/232 - 630 kW

Potenza motore ventilatore: 550 W , 2850 giri/min

Girante ventilatore: d = 318 mm, pale rovesce



DIMENSIONI [MM]

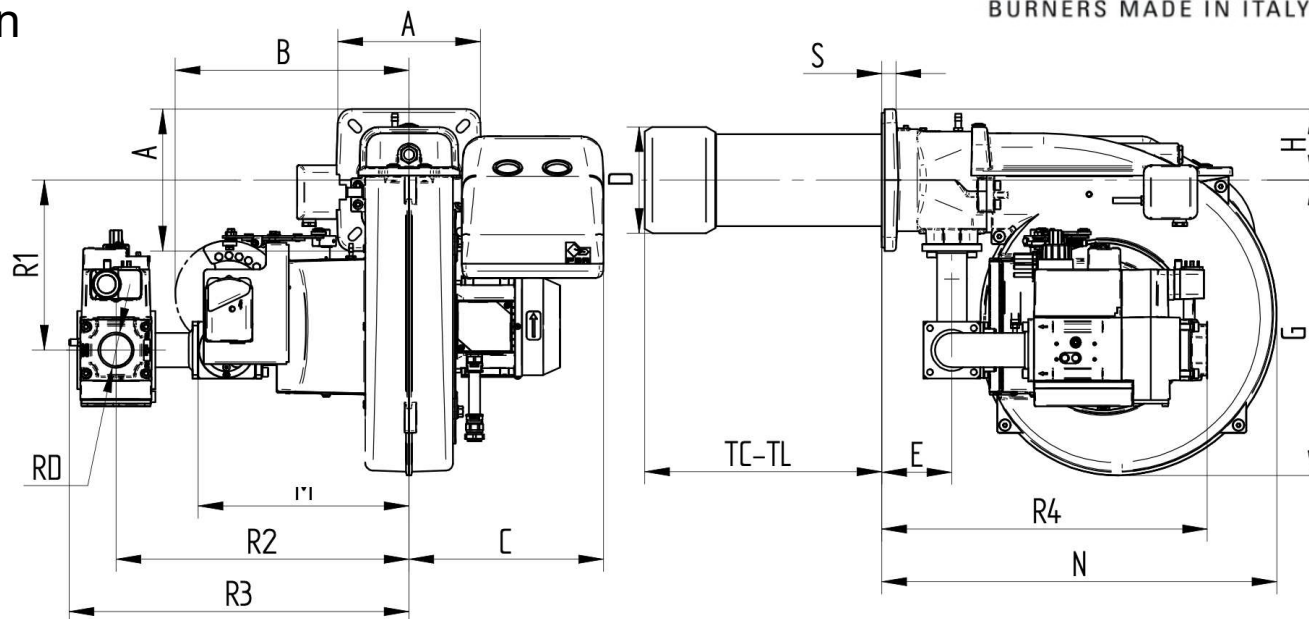


Fig. 2 Dimensioni ingombro GAS XP60/MCE-EVO

MODELLO	A	B	C	D	E	G	H	M	N	S	R1	R2	R3	R4	RD
GAS XP60/MCE-EVO - D1"-S	200	330	275	150	99	417	100	298	558	20	240	414	472	444	Rp 1



Strumentazione utilizzata:

- Fonometro Brüel & Kjær Tipo 2270 G-4 + sonda intensimetrica Tipo 3654 (per misure intensità sonora)
- Fonometro Larson Davis SoundTrack LxT (per misure pressione sonora)
- Metro a nastro

Materiali utilizzati:

- Stativo
- Nastro di carta

Purtroppo non è stato possibile effettuare una misura in caldaia.

Il bruciatore è stato quindi posto su un carrello con la fiamma spenta e il solo ventilatore funzionante alla massima potenza.

Per evitare che il flusso d'aria uscente dal bruciatore potesse alterare la misura, la camera di combustione è stata coperta con del nastro adesivo.



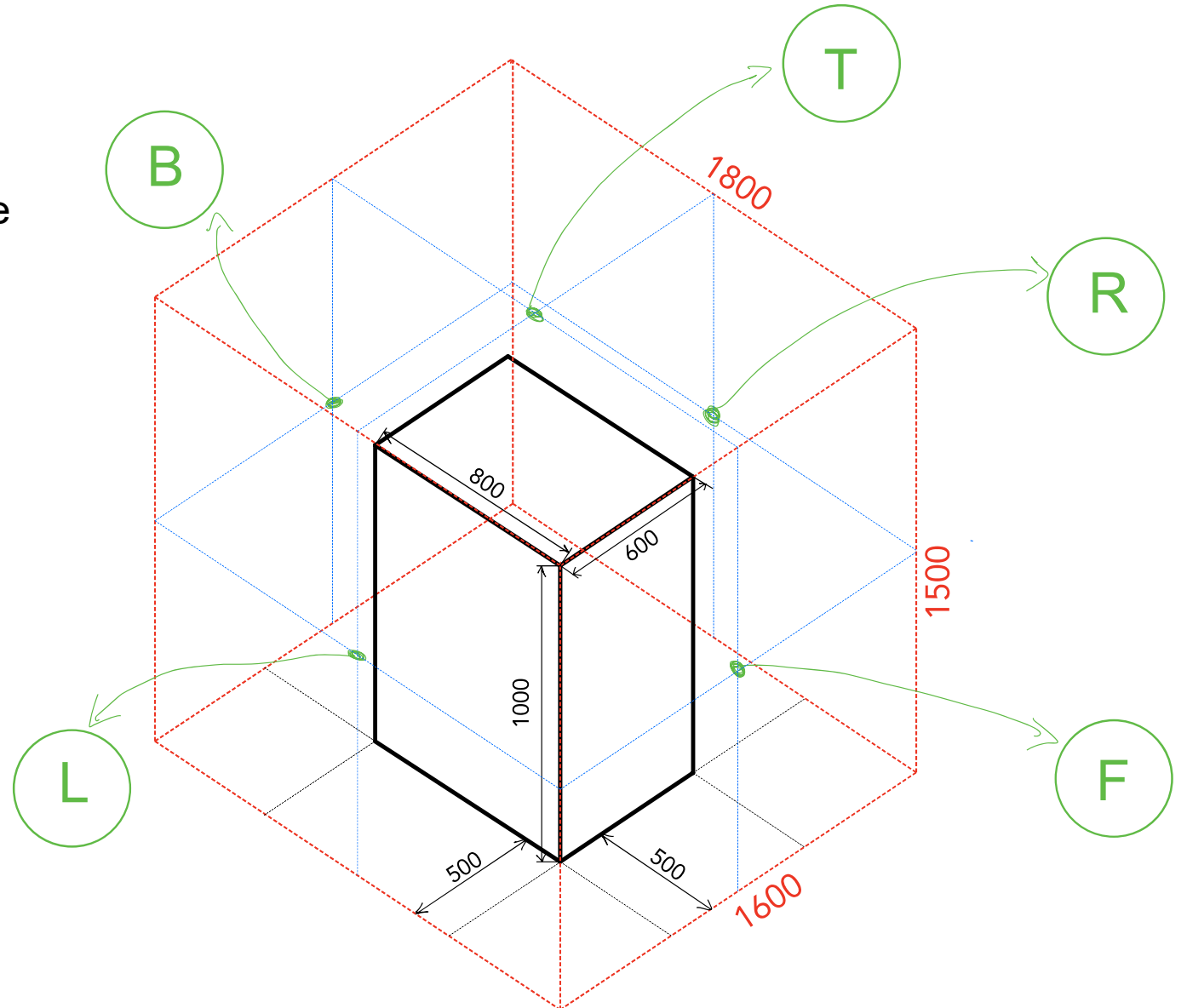
Calcolo della superficie di misura

Per mantenere una distanza di 0,5 m dal bruciatore, la superficie di misura risulta essere di 1,6 m x 1,5 m x 1,8 m.

Superficie totale: 13,08 m²

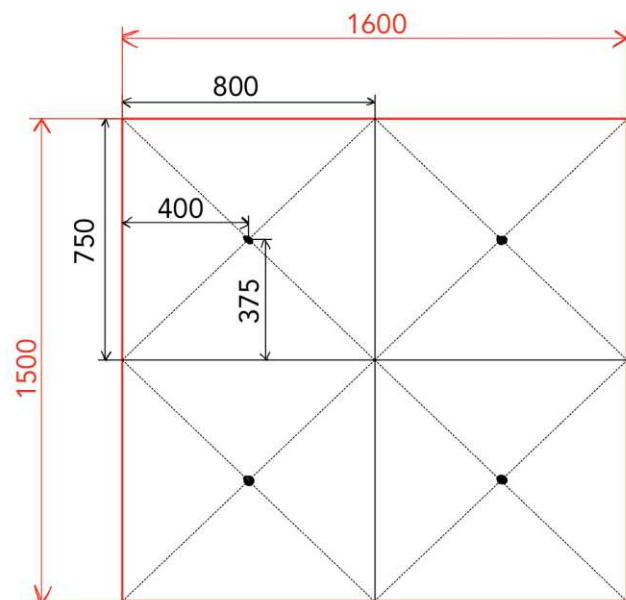
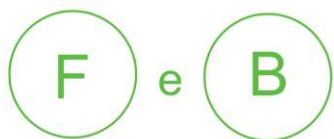


Minimo 14 punti di misura



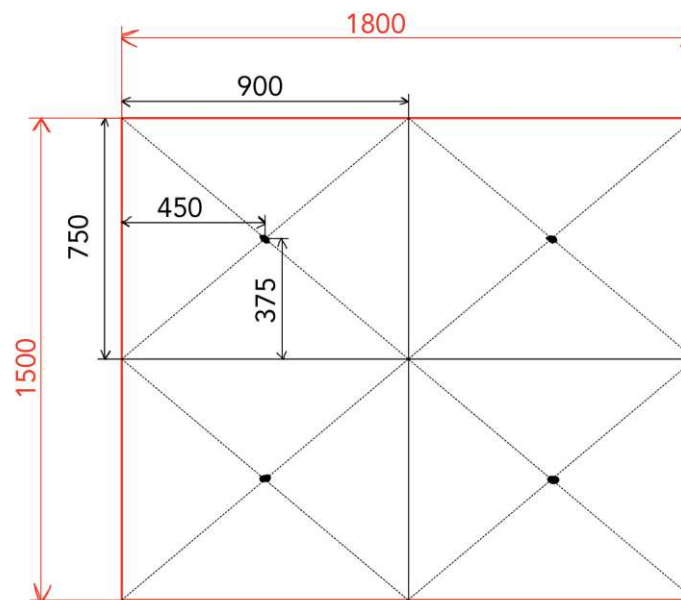
Calcolo della superficie di misura

Totale: 20 punti di misura



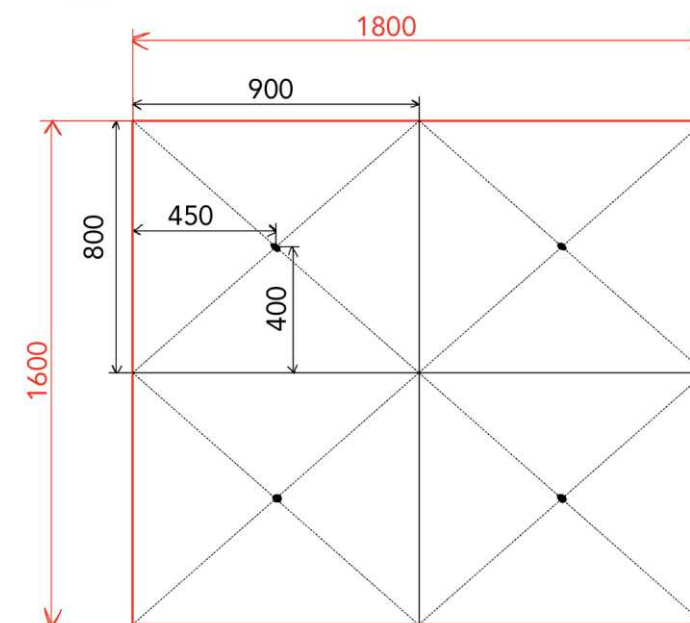
Facce Front e Back:

- 4 punti di misura ciascuna
- Area sotto-superfici: 0,6 m²



Facce Left e Right:

- 4 punti di misura ciascuna
- Area sotto-superfici: 0,675 m²



Faccia Top:

- 4 punti di misura
- Area sotto-superfici: 0,72 m²

Esecuzione delle misure

Si è proceduto nel seguente modo:

- 1) Sono stati segnati a terra e sullo stativo dei riferimenti con il nastro carta.
- 2) Si sono eseguite le misure con la sonda intensimetrica. La sonda è stata posizionata al centro di ogni sotto-superficie, direzionando l'asse il più possibile ortogonalmente alla sotto-superficie. Il tempo di misura in ogni posizione è stato di 30 s.
- 3) Si è rilevato con il fonometro di pressione i livelli di pressione sonora con il bruciatore prima in funzione e poi spento.

Purtroppo non sono state eseguite le misure ai fini del calcolo dell'indicatore F_1 .

La misura sarebbe consistita nel fare, in un unico punto della superficie, 10 rilevazioni dell'intensità sonora, della durata di 10 s ciascuna.



Dati rilevati

Livelli di Pressione Sonora (lineari, c.d. pesatura Z)

	$L_{p,Z}$ 63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Front																					
(1,1)	66,91	71,66	67,14	68,61	69,05	64,58	61,96	63,93	73,73	70,69	66,75	68,36	66,95	64,97	63,84	59,30	56,95	58,02	56,47	56,30	
(1,2)	66,56	71,59	66,65	69,14	68,55	65,96	64,04	67,07	72,20	66,34	63,67	66,18	65,56	65,15	61,69	60,83	56,70	55,88	54,96	55,35	
(2,1)	64,94	68,82	63,23	63,41	64,73	62,16	62,31	70,93	76,13	68,42	68,04	67,29	66,80	67,84	64,49	62,59	59,87	58,65	54,66	56,32	
(2,2)	64,52	69,48	63,12	63,98	65,21	62,73	60,32	71,01	79,92	70,27	66,40	66,25	64,80	62,47	60,10	58,92	57,44	54,52	52,25	52,65	
Left																					
(1,1)	67,38	74,15	70,36	69,97	72,87	70,11	65,75	67,28	77,42	73,72	70,53	73,74	69,72	69,07	67,60	66,63	61,09	60,08	60,92	62,75	
(1,2)	67,46	73,40	68,62	70,35	70,00	66,24	63,26	66,77	71,52	69,63	66,71	67,96	67,84	66,14	66,45	63,37	59,50	58,85	56,83	57,23	
(2,1)	63,52	70,20	65,58	63,28	67,02	67,15	66,24	72,80	78,55	73,45	70,19	69,77	70,41	68,62	67,00	67,28	59,75	59,75	58,46	60,26	
(2,2)	65,64	70,25	64,02	64,13	63,84	65,74	65,08	73,18	78,28	71,38	69,77	68,76	68,01	66,83	65,40	63,10	59,75	59,86	57,72	57,22	
Back																					
(1,1)	64,03	72,10	69,67	67,77	71,43	69,30	65,25	66,81	76,88	71,35	71,14	74,95	73,94	69,87	69,48	66,93	62,90	61,10	61,10	60,33	
(1,2)	64,41	72,44	70,59	69,15	72,11	70,20	66,09	67,83	72,89	72,75	71,84	75,42	73,52	70,03	68,74	65,80	64,43	62,23	58,74	59,67	
(2,1)	60,61	67,96	65,43	62,74	65,71	62,90	62,54	72,55	81,65	71,94	69,49	70,50	71,31	71,67	71,32	69,25	63,10	59,92	57,45	57,76	
(2,2)	61,90	69,03	65,84	63,36	65,57	66,13	65,29	73,54	79,02	71,70	71,59	72,55	74,35	72,46	72,09	68,07	62,97	59,87	58,15	59,42	
Right																					
(1,1)	66,41	71,34	66,24	68,16	68,38	67,03	64,07	65,20	73,30	65,32	65,71	70,46	68,28	64,66	62,09	61,14	59,34	57,52	56,23	56,21	
(1,2)	64,76	71,47	68,82	67,62	70,74	69,72	64,75	66,19	70,00	68,11	67,02	69,90	70,97	67,59	65,66	65,60	59,45	59,28	56,97	58,01	
(2,1)	63,24	68,23	62,36	62,23	61,97	62,92	59,86	68,55	76,73	69,01	65,04	61,79	64,22	63,99	61,43	59,95	57,01	55,00	54,03	53,67	
(2,2)	62,40	68,38	64,12	60,52	64,56	64,26	62,73	69,94	76,80	71,59	67,37	68,31	69,46	67,39	66,38	65,79	58,99	58,32	55,85	56,08	
Top																					
(1,1)	63,82	67,82	60,72	60,19	63,64	65,43	64,54	66,60	72,44	71,45	66,57	72,66	67,87	65,00	63,92	62,45	59,63	58,55	57,01	56,71	
(1,2)	63,30	66,73	60,58	59,72	62,49	65,35	63,79	67,39	70,21	68,68	64,17	67,03	66,06	62,58	59,96	58,40	56,81	55,10	52,68	52,85	
(2,1)	62,32	68,45	63,10	60,89	68,22	68,94	66,84	69,26	73,04	74,45	69,52	74,09	70,93	70,55	66,96	64,86	62,76	59,90	57,57	60,45	
(2,2)	61,83	67,03	62,62	59,50	67,15	67,54	65,00	70,97	75,11	71,43	70,25	71,11	70,03	68,54	67,12	65,82	59,19	57,86	55,21	54,73	

Dati rilevati

Livelli di Pressione Sonora (pesati A)

	$L_{p,A}$ 63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Front																					
(1,1)	40,71	49,16	48,04	52,51	55,65	53,68	53,36	57,33	68,93	67,49	64,85	67,56	66,95	65,57	64,84	60,50	58,25	59,22	57,47	56,80	
(1,2)	40,36	49,09	47,55	53,04	55,15	55,06	55,44	60,47	67,40	63,14	61,77	65,38	65,56	65,75	62,69	62,03	58,00	57,08	55,96	55,85	
(2,1)	38,74	46,32	44,13	47,31	51,33	51,26	53,71	64,33	71,33	65,22	66,14	66,49	66,80	68,44	65,49	63,79	61,17	59,85	55,66	56,82	
(2,2)	38,32	46,98	44,02	47,88	51,81	51,83	51,72	64,41	75,12	67,07	64,50	65,45	64,80	63,07	61,10	60,12	58,74	55,72	53,25	53,15	
Left																					
(1,1)	41,18	51,65	51,26	53,87	59,47	59,21	57,15	60,68	72,62	70,52	68,63	72,94	69,72	69,67	68,60	67,83	62,39	61,28	61,92	63,25	
(1,2)	41,26	50,90	49,52	54,25	56,60	55,34	54,66	60,17	66,72	66,43	64,81	67,16	67,84	66,74	67,45	64,57	60,80	60,05	57,83	57,73	
(2,1)	37,32	47,70	46,48	47,18	53,62	56,25	57,64	66,20	73,75	70,25	68,29	68,97	70,41	69,22	68,00	68,48	61,05	60,95	59,46	60,76	
(2,2)	39,44	47,75	44,92	48,03	50,44	54,84	56,48	66,58	73,48	68,18	67,87	67,96	68,01	67,43	66,40	64,30	61,05	61,06	58,72	57,72	
Back																					
(1,1)	37,83	49,60	50,57	51,67	58,03	58,40	56,65	60,21	72,08	68,15	69,24	74,15	73,94	70,47	70,48	68,13	64,20	62,30	62,10	60,83	
(1,2)	38,21	49,94	51,49	53,05	58,71	59,30	57,49	61,23	68,09	69,55	69,94	74,62	73,52	70,63	69,74	67,00	65,73	63,43	59,74	60,17	
(2,1)	34,41	45,46	46,33	46,64	52,31	52,00	53,94	65,95	76,85	68,74	67,59	69,70	71,31	72,27	72,32	70,45	64,40	61,12	58,45	58,26	
(2,2)	35,70	46,53	46,74	47,26	52,17	55,23	56,69	66,94	74,22	68,50	69,69	71,75	74,35	73,06	73,09	69,27	64,27	61,07	59,15	59,92	
Right																					
(1,1)	40,21	48,84	47,14	52,06	54,98	56,13	55,47	58,60	68,50	62,12	63,81	69,66	68,28	65,26	63,09	62,34	60,64	58,72	57,23	56,71	
(1,2)	38,56	48,97	49,72	51,52	57,34	58,82	56,15	59,59	65,20	64,91	65,12	69,10	70,97	68,19	66,66	66,80	60,75	60,48	57,97	58,51	
(2,1)	37,04	45,73	43,26	46,13	48,57	52,02	51,26	61,95	71,93	65,81	63,14	60,99	64,22	64,59	62,43	61,15	58,31	56,20	55,03	54,17	
(2,2)	36,20	45,88	45,02	44,42	51,16	53,36	54,13	63,34	72,00	68,39	65,47	67,51	69,46	67,99	67,38	66,99	60,29	59,52	56,85	56,58	
Top																					
(1,1)	37,62	45,32	41,62	44,09	50,24	54,53	55,94	60,00	67,64	68,25	64,67	71,86	67,87	65,60	64,92	63,65	60,93	59,75	58,01	57,21	
(1,2)	37,10	44,23	41,48	43,62	49,09	54,45	55,19	60,79	65,41	65,48	62,27	66,23	66,06	63,18	60,96	59,60	58,11	56,30	53,68	53,35	
(2,1)	36,12	45,95	44,00	44,79	54,82	58,04	58,24	62,66	68,24	71,25	67,62	73,29	70,93	71,15	67,96	66,06	64,06	61,10	58,57	60,95	
(2,2)	35,63	44,53	43,52	43,40	53,75	56,64	56,40	64,37	70,31	68,23	68,35	70,31	70,03	69,14	68,12	67,02	60,49	59,06	56,21	55,23	

Dati rilevati

Livelli di Intensità Sonora (lineari, c.d. pesatura Z)

	$L_{i,z}$	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	
	63Hz	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	
Front																					
(1,1)	[dB]	64,66	70,23	65,99	68,24	68,45	64,90	59,87	62,45	-65,21	66,80	64,71	65,85	64,66	63,15	62,27	56,68	54,66	56,03	54,85	54,35
(1,2)	[dB]	63,13	69,06	64,04	67,90	67,81	65,00	60,76	64,48	66,29	59,07	60,08	63,43	62,39	61,94	58,02	57,82	54,13	53,03	53,07	52,98
(2,1)	[dB]	62,68	67,34	61,59	63,47	60,46	60,14	60,62	68,18	73,14	65,07	65,63	66,14	64,72	65,90	62,03	60,91	58,50	57,11	52,91	54,28
(2,2)	[dB]	61,27	67,15	59,41	62,74	59,48	59,61	57,30	67,10	76,32	68,40	63,82	65,09	62,24	59,91	56,80	55,77	55,14	51,43	49,48	49,90
Left																					
(1,1)	[dB]	64,81	69,83	68,16	68,63	71,81	69,20	63,08	64,92	74,90	71,47	68,04	70,61	66,71	65,33	64,53	62,98	57,96	57,93	58,77	60,39
(1,2)	[dB]	64,00	69,07	66,81	67,76	69,43	65,96	61,11	63,59	69,31	67,22	63,13	64,43	65,19	62,77	63,63	58,46	55,31	56,29	54,60	54,75
(2,1)	[dB]	61,96	66,56	63,89	62,89	66,08	65,91	64,56	69,23	73,77	71,42	67,93	67,20	68,71	66,03	64,67	64,71	57,07	57,00	56,71	57,57
(2,2)	[dB]	63,52	67,25	63,10	63,13	62,73	62,87	62,97	69,86	75,77	69,90	67,10	65,77	64,83	63,70	61,95	59,49	57,43	57,56	55,79	55,28
Back																					
(1,1)	[dB]	61,77	67,41	66,38	66,67	70,88	67,62	61,93	65,25	72,71	66,52	68,31	72,08	72,06	66,30	65,42	64,91	59,59	58,74	59,47	57,34
(1,2)	[dB]	62,71	68,31	67,78	68,61	71,71	69,66	63,53	64,10	66,59	69,17	68,66	70,39	70,24	66,17	65,16	61,92	61,97	60,34	56,91	57,88
(2,1)	[dB]	59,41	64,15	61,50	60,95	64,12	61,45	60,95	69,59	77,45	70,01	68,01	68,34	69,81	69,73	69,11	67,55	60,67	57,60	54,94	55,05
(2,2)	[dB]	61,21	66,08	63,40	63,48	65,82	65,19	63,70	71,32	76,08	71,11	69,60	70,40	71,47	70,27	67,91	66,40	61,33	57,64	56,52	57,60
Right																					
(1,1)	[dB]	63,28	68,65	65,13	66,27	68,43	65,99	60,28	62,28	66,50	58,28	62,32	69,01	65,76	61,07	58,26	58,40	56,13	54,66	54,00	53,16
(1,2)	[dB]	62,39	68,65	66,99	66,79	69,96	68,29	61,63	62,75	65,31	65,22	64,53	67,77	68,69	64,97	62,34	63,34	56,37	57,52	54,90	55,53
(2,1)	[dB]	59,86	65,55	60,57	60,72	60,78	58,09	56,24	64,88	74,93	66,02	60,68	57,67	58,05	58,80	57,27	55,29	53,75	51,57	51,20	49,70
(2,2)	[dB]	60,91	66,35	62,65	60,99	63,28	62,69	60,35	68,13	74,37	69,89	66,22	66,58	67,69	65,25	64,14	63,82	56,52	56,23	53,80	54,08
Top																					
(1,1)	[dB]	61,88	65,93	59,07	57,17	61,86	63,83	62,99	64,24	68,57	69,16	63,86	69,84	65,19	62,38	60,04	59,97	57,10	56,76	55,64	54,44
(1,2)	[dB]	60,80	64,97	58,10	56,35	60,68	63,45	61,89	64,87	66,36	65,41	60,45	64,76	61,34	58,11	55,11	53,94	53,76	52,27	50,41	50,10
(2,1)	[dB]	61,67	66,41	62,13	59,31	67,03	67,72	65,78	68,24	70,57	72,67	68,31	72,95	69,25	69,03	65,13	63,16	61,28	58,86	56,90	59,24
(2,2)	[dB]	60,40	65,00	60,60	57,35	65,17	66,19	63,89	69,31	72,19	69,86	68,68	69,07	68,17	66,86	65,43	64,06	57,50	56,25	54,11	52,44

Dati rilevati

Livelli di Intensità Sonora (pesati A)

	$L_{i,A}$ 63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	
	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]	[dB]
Front																					
(1,1)	38,46	47,73	46,89	52,14	55,05	54,00	51,27	55,85	-60,41	63,60	62,81	65,05	64,66	63,75	63,27	57,88	55,96	57,23	55,85	54,85	
(1,2)	36,93	46,56	44,94	51,80	54,41	54,10	52,16	57,88	61,49	55,87	58,18	62,63	62,39	62,54	59,02	59,02	55,43	54,23	54,07	53,48	
(2,1)	36,48	44,84	42,49	47,37	47,06	49,24	52,02	61,58	68,34	61,87	63,73	65,34	64,72	66,50	63,03	62,11	59,80	58,31	53,91	54,78	
(2,2)	35,07	44,65	40,31	46,64	46,08	48,71	48,70	60,50	71,52	65,20	61,92	64,29	62,24	60,51	57,80	56,97	56,44	52,63	50,48	50,40	
Left																					
(1,1)	38,61	47,33	49,06	52,53	58,41	58,30	54,48	58,32	70,10	68,27	66,14	69,81	66,71	65,93	65,53	64,18	59,26	59,13	59,77	60,89	
(1,2)	37,80	46,57	47,71	51,66	56,03	55,06	52,51	56,99	64,51	64,02	61,23	63,63	65,19	63,37	64,63	59,66	56,61	57,49	55,60	55,25	
(2,1)	35,76	44,06	44,79	46,79	52,68	55,01	55,96	62,63	68,97	68,22	66,03	66,40	68,71	66,63	65,67	65,91	58,37	58,20	57,71	58,07	
(2,2)	37,32	44,75	44,00	47,03	49,33	51,97	54,37	63,26	70,97	66,70	65,20	64,97	64,83	64,30	62,95	60,69	58,73	58,76	56,79	55,78	
Back																					
(1,1)	35,57	44,91	47,28	50,57	57,48	56,72	53,33	58,65	67,91	63,32	66,41	71,28	72,06	66,90	66,42	66,11	60,89	59,94	60,47	57,84	
(1,2)	36,51	45,81	48,68	52,51	58,31	58,76	54,93	57,50	61,79	65,97	66,76	69,59	70,24	66,77	66,16	63,12	63,27	61,54	57,91	58,38	
(2,1)	33,21	41,65	42,40	44,85	50,72	50,55	52,35	62,99	72,65	66,81	66,11	67,54	69,81	70,33	70,11	68,75	61,97	58,80	55,94	55,55	
(2,2)	35,01	43,58	44,30	47,38	52,42	54,29	55,10	64,72	71,28	67,91	67,70	69,60	71,47	70,87	68,91	67,60	62,63	58,84	57,52	58,10	
Right																					
(1,1)	37,08	46,15	46,03	50,17	55,03	55,09	51,68	55,68	61,70	55,08	60,42	68,21	65,76	61,67	59,26	59,60	57,43	55,86	55,00	53,66	
(1,2)	36,19	46,15	47,89	50,69	56,56	57,39	53,03	56,15	60,51	62,02	62,63	66,97	68,69	65,57	63,34	64,54	57,67	58,72	55,90	56,03	
(2,1)	33,66	43,05	41,47	44,62	47,38	47,19	47,64	58,28	70,13	62,82	58,78	56,87	58,05	59,40	58,27	56,49	55,05	52,77	52,20	50,20	
(2,2)	34,71	43,85	43,55	44,89	49,88	51,79	51,75	61,53	69,57	66,69	64,32	65,78	67,69	65,85	65,14	65,02	57,82	57,43	54,80	54,58	
Top																					
(1,1)	35,68	43,43	39,97	41,07	48,46	52,93	54,39	57,64	63,77	65,96	61,96	69,04	65,19	62,98	61,04	61,17	58,40	57,96	56,64	54,94	
(1,2)	34,60	42,47	39,00	40,25	47,28	52,55	53,29	58,27	61,56	62,21	58,55	63,96	61,34	58,71	56,11	55,14	55,06	53,47	51,41	50,60	
(2,1)	35,47	43,91	43,03	43,21	53,63	56,82	57,18	61,64	65,77	69,47	66,41	72,15	69,25	69,63	66,13	64,36	62,58	60,06	57,90	59,74	
(2,2)	34,20	42,50	41,50	41,25	51,77	55,29	55,29	62,71	67,39	66,66	66,78	68,27	68,17	67,46	66,43	65,26	58,80	57,45	55,11	52,94	

Calcolo Intensità Sonora (pesatura Z)

$$I_n = \text{sgn}(L_I) 10^{-12} 10^{|0,1 L_I|}$$

	$I_{n,Z}$ 63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
Front	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]
(1,1)	2,92E-06	1,1E-05	4E-06	6,7E-06	7E-06	3,09E-06	9,71E-07	1,76E-06	-3,3E-06	4,79E-06	2,96E-06	3,85E-06	2,92E-06	2,07E-06	1,69E-06	4,66E-07	2,92E-07	4,01E-07	3,05E-07	2,72E-07
(1,2)	2,06E-06	8,1E-06	2,5E-06	6,2E-06	6,04E-06	3,16E-06	1,19E-06	2,81E-06	4,26E-06	8,07E-07	1,02E-06	2,2E-06	1,73E-06	1,56E-06	6,34E-07	6,05E-07	2,59E-07	2,01E-07	2,03E-07	1,99E-07
(2,1)	1,85E-06	5,4E-06	1,4E-06	2,2E-06	1,11E-06	1,03E-06	1,15E-06	6,58E-06	2,06E-05	3,21E-06	3,66E-06	4,11E-06	2,96E-06	3,89E-06	1,6E-06	1,23E-06	7,08E-07	5,14E-07	1,95E-07	2,68E-07
(2,2)	1,34E-06	5,2E-06	8,7E-07	1,9E-06	8,87E-07	9,14E-07	5,37E-07	5,13E-06	4,29E-05	6,92E-06	2,41E-06	3,23E-06	1,67E-06	9,79E-07	4,79E-07	3,78E-07	3,27E-07	1,39E-07	8,87E-08	9,77E-08
Left																				
(1,1)	3,03E-06	9,6E-06	6,5E-06	7,3E-06	1,52E-05	8,32E-06	2,03E-06	3,1E-06	3,09E-05	1,4E-05	6,37E-06	1,15E-05	4,69E-06	3,41E-06	2,84E-06	1,99E-06	6,25E-07	6,21E-07	7,53E-07	1,09E-06
(1,2)	2,51E-06	8,1E-06	4,8E-06	6E-06	8,77E-06	3,94E-06	1,29E-06	2,29E-06	8,53E-06	5,27E-06	2,06E-06	2,77E-06	3,3E-06	1,89E-06	2,31E-06	7,01E-07	3,4E-07	4,26E-07	2,88E-07	2,99E-07
(2,1)	1,57E-06	4,5E-06	2,4E-06	1,9E-06	4,06E-06	3,9E-06	2,86E-06	8,38E-06	2,38E-05	1,39E-05	6,21E-06	5,25E-06	7,43E-06	4,01E-06	2,93E-06	2,96E-06	5,09E-07	5,01E-07	4,69E-07	5,71E-07
(2,2)	2,25E-06	5,3E-06	2E-06	2,1E-06	1,87E-06	1,94E-06	1,98E-06	9,68E-06	3,78E-05	9,77E-06	5,13E-06	3,78E-06	3,04E-06	2,34E-06	1,57E-06	8,89E-07	5,53E-07	5,7E-07	3,79E-07	3,37E-07
Back																				
(1,1)	1,5E-06	5,5E-06	4,3E-06	4,6E-06	1,22E-05	5,78E-06	1,56E-06	3,35E-06	1,87E-05	4,49E-06	6,78E-06	1,61E-05	1,61E-05	4,27E-06	3,48E-06	3,1E-06	9,1E-07	7,48E-07	8,85E-07	5,42E-07
(1,2)	1,87E-06	6,8E-06	6E-06	7,3E-06	1,48E-05	9,25E-06	2,25E-06	2,57E-06	4,56E-06	8,26E-06	7,35E-06	1,09E-05	1,06E-05	4,14E-06	3,28E-06	1,56E-06	1,57E-06	1,08E-06	4,91E-07	6,14E-07
(2,1)	8,73E-07	2,6E-06	1,4E-06	1,2E-06	2,58E-06	1,4E-06	1,24E-06	9,1E-06	5,56E-05	1E-05	6,32E-06	6,82E-06	9,57E-06	9,4E-06	8,15E-06	5,69E-06	1,17E-06	5,75E-07	3,12E-07	3,2E-07
(2,2)	1,32E-06	4,1E-06	2,2E-06	2,2E-06	3,82E-06	3,3E-06	2,34E-06	1,36E-05	4,06E-05	1,29E-05	9,12E-06	1,1E-05	1,4E-05	1,06E-05	6,18E-06	4,37E-06	1,36E-06	5,81E-07	4,49E-07	5,75E-07
Right																				
(1,1)	2,13E-06	7,3E-06	3,3E-06	4,2E-06	6,97E-06	3,97E-06	1,07E-06	1,69E-06	4,47E-06	6,73E-07	1,71E-06	7,96E-06	3,77E-06	1,28E-06	6,7E-07	6,92E-07	4,1E-07	2,92E-07	2,51E-07	2,07E-07
(1,2)	1,73E-06	7,3E-06	5E-06	4,8E-06	9,91E-06	6,75E-06	1,46E-06	1,88E-06	3,4E-06	3,33E-06	2,84E-06	5,98E-06	7,4E-06	3,14E-06	1,71E-06	2,16E-06	4,34E-07	5,65E-07	3,09E-07	3,57E-07
(2,1)	9,68E-07	3,6E-06	1,1E-06	1,2E-06	1,2E-06	6,44E-07	4,21E-07	3,08E-06	3,11E-05	4E-06	1,17E-06	5,85E-07	6,38E-07	7,59E-07	5,33E-07	3,38E-07	2,37E-07	1,44E-07	1,32E-07	9,33E-08
(2,2)	1,23E-06	4,3E-06	1,8E-06	1,3E-06	2,13E-06	1,86E-06	1,08E-06	6,5E-06	2,74E-05	9,75E-06	4,19E-06	4,55E-06	5,87E-06	3,35E-06	2,59E-06	2,41E-06	4,49E-07	4,2E-07	2,4E-07	2,56E-07
Top																				
(1,1)	1,54E-06	3,9E-06	8,1E-07	5,2E-07	1,53E-06	2,42E-06	1,99E-06	2,65E-06	7,19E-06	8,24E-06	2,43E-06	9,64E-06	3,3E-06	1,73E-06	1,01E-06	9,93E-07	5,13E-07	4,74E-07	3,66E-07	2,78E-07
(1,2)	1,2E-06	3,1E-06	6,5E-07	4,3E-07	1,17E-06	2,21E-06	1,55E-06	3,07E-06	4,33E-06	3,48E-06	1,11E-06	2,99E-06	1,36E-06	6,47E-07	3,24E-07	2,48E-07	2,38E-07	1,69E-07	1,1E-07	1,02E-07
(2,1)	1,47E-06	4,4E-06	1,6E-06	8,5E-07	5,05E-06	5,92E-06	3,78E-06	6,67E-06	1,14E-05	1,85E-05	6,78E-06	1,97E-05	8,41E-06	8E-06	3,26E-06	2,07E-06	1,34E-06	7,69E-07	4,9E-07	8,39E-07
(2,2)	1,1E-06	3,2E-06	1,1E-06	5,4E-07	3,29E-06	4,16E-06	2,45E-06	8,53E-06	1,66E-05	9,68E-06	7,38E-06	8,07E-06	6,56E-06	4,85E-06	3,49E-06	2,55E-06	5,62E-07	4,22E-07	2,58E-07	1,75E-07

Calcolo Intensità Sonora (pesatura A)

$$I_n = \text{sgn}(L_I) 10^{-12} 10^{0,1 L_I}$$

	$I_{n,A}$ 63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	
	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	[W/m ²]	
Front																					
(1,1)	7,01E-09	5,93E-08	4,89E-08	1,64E-07	3,2E-07	2,51E-07	1,34E-07	3,85E-07	-1,1E-06	2,29E-06	1,91E-06	3,2E-06	2,92E-06	2,37E-06	2,12E-06	6,14E-07	3,94E-07	5,28E-07	3,85E-07	3,05E-07	
(1,2)	4,93E-09	4,53E-08	3,12E-08	1,51E-07	2,76E-07	2,57E-07	1,64E-07	6,14E-07	1,41E-06	3,86E-07	6,58E-07	1,83E-06	1,73E-06	1,79E-06	7,98E-07	7,98E-07	3,49E-07	2,65E-07	2,55E-07	2,23E-07	
(2,1)	4,45E-09	3,05E-08	1,77E-08	5,46E-08	5,08E-08	8,39E-08	1,59E-07	1,44E-06	6,82E-06	1,54E-06	2,36E-06	3,42E-06	2,96E-06	4,47E-06	2,01E-06	1,63E-06	9,55E-07	6,78E-07	2,46E-07	3,01E-07	
(2,2)	3,21E-09	2,92E-08	1,07E-08	4,61E-08	4,06E-08	7,43E-08	7,41E-08	1,12E-06	1,42E-05	3,31E-06	1,56E-06	2,69E-06	1,67E-06	1,12E-06	6,03E-07	4,98E-07	4,41E-07	1,83E-07	1,12E-07	1,1E-07	
Left																					
(1,1)	7,26E-09	5,41E-08	8,05E-08	1,79E-07	6,93E-07	6,76E-07	2,81E-07	6,79E-07	1,02E-05	6,71E-06	4,11E-06	9,57E-06	4,69E-06	3,92E-06	3,57E-06	2,62E-06	8,43E-07	8,18E-07	9,48E-07	1,23E-06	
(1,2)	6,03E-09	4,54E-08	5,9E-08	1,47E-07	4,01E-07	3,21E-07	1,78E-07	5E-07	2,82E-06	2,52E-06	1,33E-06	2,31E-06	3,3E-06	2,17E-06	2,9E-06	9,25E-07	4,58E-07	5,61E-07	3,63E-07	3,35E-07	
(2,1)	3,77E-09	2,55E-08	3,01E-08	4,78E-08	1,85E-07	3,17E-07	3,94E-07	1,83E-06	7,89E-06	6,64E-06	4,01E-06	4,37E-06	7,43E-06	4,6E-06	3,69E-06	3,9E-06	6,87E-07	6,61E-07	5,9E-07	6,41E-07	
(2,2)	5,4E-09	2,99E-08	2,51E-08	5,05E-08	8,57E-08	1,57E-07	2,74E-07	2,12E-06	1,25E-05	4,68E-06	3,31E-06	3,14E-06	3,04E-06	2,69E-06	1,97E-06	1,17E-06	7,46E-07	7,52E-07	4,78E-07	3,78E-07	
Back																					
(1,1)	3,61E-09	3,1E-08	5,35E-08	1,14E-07	5,6E-07	4,7E-07	2,15E-07	7,33E-07	6,18E-06	2,15E-06	4,38E-06	1,34E-05	1,61E-05	4,9E-06	4,39E-06	4,08E-06	1,23E-06	9,86E-07	1,11E-06	6,08E-07	
(1,2)	4,48E-09	3,81E-08	7,38E-08	1,78E-07	6,78E-07	7,52E-07	3,11E-07	5,62E-07	1,51E-06	3,95E-06	4,74E-06	9,1E-06	1,06E-05	4,75E-06	4,13E-06	2,05E-06	2,12E-06	1,43E-06	6,18E-07	6,89E-07	
(2,1)	2,09E-09	1,46E-08	1,74E-08	3,05E-08	1,18E-07	1,14E-07	1,72E-07	1,99E-06	1,84E-05	4,8E-06	4,08E-06	5,68E-06	9,57E-06	1,08E-05	1,03E-05	7,5E-06	1,57E-06	7,59E-07	3,93E-07	3,59E-07	
(2,2)	3,17E-09	2,28E-08	2,69E-08	5,47E-08	1,75E-07	2,69E-07	3,24E-07	2,96E-06	1,34E-05	6,18E-06	5,89E-06	9,12E-06	1,4E-05	1,22E-05	7,78E-06	5,75E-06	1,83E-06	7,66E-07	5,65E-07	6,46E-07	
Right																					
(1,1)	5,11E-09	4,12E-08	4,01E-08	1,04E-07	3,18E-07	3,23E-07	1,47E-07	3,7E-07	1,48E-06	3,22E-07	1,1E-06	6,62E-06	3,77E-06	1,47E-06	8,43E-07	9,12E-07	5,53E-07	3,85E-07	3,16E-07	2,32E-07	
(1,2)	4,16E-09	4,12E-08	6,15E-08	1,17E-07	4,53E-07	5,48E-07	2,01E-07	4,12E-07	1,12E-06	1,59E-06	1,83E-06	4,98E-06	7,4E-06	3,61E-06	2,16E-06	2,84E-06	5,85E-07	7,45E-07	3,89E-07	4,01E-07	
(2,1)	2,32E-09	2,02E-08	1,4E-08	2,9E-08	5,47E-08	5,24E-08	5,81E-08	6,73E-07	1,03E-05	1,91E-06	7,55E-07	4,86E-07	6,38E-07	8,71E-07	6,71E-07	4,46E-07	3,2E-07	1,89E-07	1,66E-07	1,05E-07	
(2,2)	2,96E-09	2,43E-08	2,26E-08	3,08E-08	9,73E-08	1,51E-07	1,5E-07	1,42E-06	9,06E-06	4,67E-06	2,7E-06	3,78E-06	5,87E-06	3,85E-06	3,27E-06	3,18E-06	6,05E-07	5,53E-07	3,02E-07	2,87E-07	
Top																					
(1,1)	3,7E-09	2,2E-08	9,93E-09	1,28E-08	7,01E-08	1,96E-07	2,75E-07	5,81E-07	2,38E-06	3,94E-06	1,57E-06	8,02E-06	3,3E-06	1,99E-06	1,27E-06	1,31E-06	6,92E-07	6,25E-07	4,61E-07	3,12E-07	
(1,2)	2,88E-09	1,77E-08	7,94E-09	1,06E-08	5,35E-08	1,8E-07	2,13E-07	6,71E-07	1,43E-06	1,66E-06	7,16E-07	2,49E-06	1,36E-06	7,43E-07	4,08E-07	3,27E-07	3,21E-07	2,22E-07	1,38E-07	1,15E-07	
(2,1)	3,52E-09	2,46E-08	2,01E-08	2,09E-08	2,31E-07	4,81E-07	5,22E-07	1,46E-06	3,78E-06	8,85E-06	4,38E-06	1,64E-05	8,41E-06	9,18E-06	4,1E-06	2,73E-06	1,81E-06	1,01E-06	6,17E-07	9,42E-07	
(2,2)	2,63E-09	1,78E-08	1,41E-08	1,33E-08	1,5E-07	3,38E-07	3,38E-07	1,87E-06	5,48E-06	4,63E-06	4,76E-06	6,71E-06	6,56E-06	5,57E-06	4,4E-06	3,36E-06	7,59E-07	5,56E-07	3,24E-07	1,97E-07	

Calcolo Potenza Sonora (pesatura Z)

$$P_i = I_{n,i} S_i$$

$$L_{w,i} = 10 \log \sum_{63\text{Hz}}^{5\text{kHz}} \frac{P_i}{10^{-12}}$$

	Larghezza [m]	Altezza [m]	S _i [m ²]
Front	0,750	0,800	0,600
Left	0,750	0,900	0,675
Back	0,750	0,800	0,600
Right	0,750	0,900	0,675
Top	0,900	0,800	0,720

Livelli di potenza sonora (pesati Z)
di ogni sotto-superficie

	P _{i,z} 63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	L _{w,z,i} [dB]	
Front																						
(1,1)	1,75E-06	6,33E-06	2,38E-06	4E-06	4,2E-06	1,85E-06	5,82E-07	1,05E-06	2E-06	2,87E-06	1,77E-06	2,31E-06	1,75E-06	1,24E-06	1,01E-06	2,79E-07	1,75E-07	2,41E-07	1,83E-07	1,63E-07	75,07	
(1,2)	1,23E-06	4,83E-06	1,52E-06	3,7E-06	3,62E-06	1,9E-06	7,15E-07	1,68E-06	2,55E-06	4,84E-07	6,11E-07	1,32E-06	1,04E-06	9,38E-07	3,8E-07	3,63E-07	1,55E-07	1,21E-07	1,22E-07	1,19E-07	74,38	
(2,1)	1,11E-06	3,25E-06	8,65E-07	1,33E-06	6,67E-07	6,2E-07	6,92E-07	3,95E-06	1,24E-05	1,93E-06	2,19E-06	2,47E-06	1,78E-06	2,33E-06	9,58E-07	7,4E-07	4,25E-07	3,08E-07	1,17E-07	1,61E-07	75,83	
(2,2)	8,04E-07	3,11E-06	5,24E-07	1,13E-06	5,32E-07	5,48E-07	3,22E-07	3,08E-06	2,57E-05	4,15E-06	1,45E-06	1,94E-06	1E-06	5,88E-07	2,87E-07	2,27E-07	1,96E-07	8,34E-08	5,32E-08	5,86E-08	76,61	
Left																						
(1,1)	2,04E-06	6,49E-06	4,42E-06	4,92E-06	1,02E-05	5,61E-06	1,37E-06	2,1E-06	2,09E-05	9,47E-06	4,3E-06	7,77E-06	3,16E-06	2,3E-06	1,92E-06	1,34E-06	4,22E-07	4,19E-07	5,09E-07	7,38E-07	79,56	
(1,2)	1,7E-06	5,45E-06	3,24E-06	4,03E-06	5,92E-06	2,66E-06	8,72E-07	1,54E-06	5,76E-06	3,56E-06	1,39E-06	1,87E-06	2,23E-06	1,28E-06	1,56E-06	4,73E-07	2,29E-07	2,87E-07	1,95E-07	2,02E-07	76,48	
(2,1)	1,06E-06	3,06E-06	1,65E-06	1,31E-06	2,74E-06	2,63E-06	1,93E-06	5,65E-06	1,61E-05	9,36E-06	4,19E-06	3,54E-06	5,02E-06	2,71E-06	1,98E-06	2E-06	3,44E-07	3,38E-07	3,16E-07	3,86E-07	78,21	
(2,2)	1,52E-06	3,58E-06	1,38E-06	1,39E-06	1,27E-06	1,31E-06	1,34E-06	6,54E-06	2,55E-05	6,6E-06	3,46E-06	2,55E-06	2,05E-06	1,58E-06	1,06E-06	6E-07	3,74E-07	3,85E-07	2,56E-07	2,28E-07	77,99	
Back																						
(1,1)	9,02E-07	3,3E-06	2,61E-06	2,79E-06	7,35E-06	3,47E-06	9,36E-07	2,01E-06	1,12E-05	2,69E-06	4,07E-06	9,69E-06	9,64E-06	2,56E-06	2,09E-06	1,86E-06	5,46E-07	4,49E-07	5,31E-07	3,25E-07	78,39	
(1,2)	1,12E-06	4,07E-06	3,6E-06	4,36E-06	8,9E-06	5,55E-06	1,35E-06	1,54E-06	2,74E-06	4,96E-06	4,41E-06	6,56E-06	6,34E-06	2,48E-06	1,97E-06	9,34E-07	9,44E-07	6,49E-07	2,95E-07	3,68E-07	78,00	
(2,1)	5,24E-07	1,56E-06	8,48E-07	7,47E-07	1,55E-06	8,38E-07	7,47E-07	5,46E-06	3,34E-05	6,01E-06	3,79E-06	4,09E-06	5,74E-06	5,64E-06	4,89E-06	3,41E-06	7E-07	3,45E-07	1,87E-07	1,92E-07	79,07	
(2,2)	7,93E-07	2,43E-06	1,31E-06	1,34E-06	2,29E-06	1,98E-06	1,41E-06	8,13E-06	2,43E-05	7,75E-06	5,47E-06	6,58E-06	8,42E-06	6,38E-06	3,71E-06	2,62E-06	8,15E-07	3,48E-07	2,69E-07	3,45E-07	79,38	
Right																						
(1,1)	1,44E-06	4,95E-06	2,2E-06	2,86E-06	4,7E-06	2,68E-06	7,2E-07	1,14E-06	3,02E-06	4,54E-07	1,15E-06	5,37E-06	2,54E-06	8,64E-07	4,52E-07	4,67E-07	2,77E-07	1,97E-07	1,7E-07	1,4E-07	75,54	
(1,2)	1,17E-06	4,95E-06	3,38E-06	3,22E-06	6,69E-06	4,55E-06	9,82E-07	1,27E-06	2,29E-06	2,25E-06	1,92E-06	4,04E-06	4,99E-06	2,12E-06	1,16E-06	1,46E-06	2,93E-07	3,81E-07	2,09E-07	2,41E-07	76,77	
(2,1)	6,54E-07	2,42E-06	7,7E-07	7,97E-07	8,08E-07	4,35E-07	2,84E-07	2,08E-06	2,1E-05	2,7E-06	7,89E-07	3,95E-07	4,31E-07	5,12E-07	3,6E-07	2,28E-07	1,6E-07	9,69E-08	8,9E-08	6,3E-08	75,45	
(2,2)	8,32E-07	2,91E-06	1,24E-06	8,48E-07	1,44E-06	1,25E-06	7,32E-07	4,39E-06	1,85E-05	6,58E-06	2,83E-06	3,07E-06	3,97E-06	2,26E-06	1,75E-06	1,63E-06	3,03E-07	2,83E-07	1,62E-07	1,73E-07	77,41	
Top																						
(1,1)	1,11E-06	2,82E-06	5,81E-07	3,75E-07	1,1E-06	1,74E-06	1,43E-06	1,91E-06	5,18E-06	5,93E-06	1,75E-06	6,94E-06	2,38E-06	1,25E-06	7,27E-07	7,15E-07	3,69E-07	3,41E-07	2,64E-07	2E-07	75,70	
(1,2)	8,66E-07	2,26E-06	4,65E-07	3,11E-07	8,42E-07	1,59E-06	1,11E-06	2,21E-06	3,11E-06	2,5E-06	7,99E-07	2,15E-06	9,8E-07	4,66E-07	2,34E-07	1,78E-07	1,71E-07	1,21E-07	7,91E-08	7,37E-08	73,12	
(2,1)	1,06E-06	3,15E-06	1,18E-06	6,14E-07	3,63E-06	4,26E-06	2,72E-06	4,8E-06	8,21E-06	1,33E-05	4,88E-06	1,42E-05	6,06E-06	5,76E-06	2,35E-06	1,49E-06	9,67E-07	5,54E-07	3,53E-07	6,04E-07	79,04	
(2,2)	7,89E-07	2,28E-06	8,27E-07	3,91E-07	2,37E-06	2,99E-06	1,76E-06	6,14E-06	1,19E-05	6,97E-06	5,31E-06	5,81E-06	4,72E-06	3,49E-06	2,51E-06	1,83E-06	4,05E-07	3,04E-07	1,85E-07	1,26E-07	77,86	

Calcolo Potenza Sonora (pesatura A)

$$P_i = I_{n,i} S_i$$

$$L_{w,i} = 10 \log \sum_{63\text{Hz}}^{5\text{kHz}} \frac{P_i}{10^{-12}}$$

	Larghezza [m]	Altezza [m]	S _i [m ²]
Front	0,750	0,800	0,600
Left	0,750	0,900	0,675
Back	0,750	0,800	0,600
Right	0,750	0,900	0,675
Top	0,900	0,800	0,720

Livelli di potenza sonora (pesati A)
di ogni sotto-superficie

	P _{i,A} 63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	L _{w,A,i} [dB]
Front	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	[W]	
(1,1)	4,21E-09	3,56E-08	2,93E-08	9,82E-08	1,92E-07	1,51E-07	8,04E-08	2,31E-07	-6,6E-07	1,37E-06	1,15E-06	1,92E-06	1,75E-06	1,42E-06	1,27E-06	3,68E-07	2,37E-07	3,17E-07	2,31E-07	1,83E-07	70,17
(1,2)	2,96E-09	2,72E-08	1,87E-08	9,08E-08	1,66E-07	1,54E-07	9,87E-08	3,68E-07	8,46E-07	2,32E-07	3,95E-07	1,1E-06	1,04E-06	1,08E-06	4,79E-07	4,79E-07	2,09E-07	1,59E-07	1,53E-07	1,34E-07	68,59
(2,1)	2,67E-09	1,83E-08	1,06E-08	3,27E-08	3,05E-08	5,04E-08	9,55E-08	8,63E-07	4,09E-06	9,23E-07	1,42E-06	2,05E-06	1,78E-06	2,68E-06	1,21E-06	9,75E-07	5,73E-07	4,07E-07	1,48E-07	1,8E-07	72,44
(2,2)	1,93E-09	1,75E-08	6,44E-09	2,77E-08	2,43E-08	4,46E-08	4,45E-08	6,73E-07	8,51E-06	1,99E-06	9,34E-07	1,61E-06	1E-06	6,75E-07	3,62E-07	2,99E-07	2,64E-07	1,1E-07	6,7E-08	6,58E-08	72,24
Left																					
(1,1)	4,9E-09	3,65E-08	5,44E-08	1,21E-07	4,68E-07	4,56E-07	1,89E-07	4,58E-07	6,91E-06	4,53E-06	2,78E-06	6,46E-06	3,16E-06	2,64E-06	2,41E-06	1,77E-06	5,69E-07	5,52E-07	6,4E-07	8,29E-07	75,45
(1,2)	4,07E-09	3,06E-08	3,98E-08	9,89E-08	2,71E-07	2,16E-07	1,2E-07	3,38E-07	1,91E-06	1,7E-06	8,96E-07	1,56E-06	2,23E-06	1,47E-06	1,96E-06	6,24E-07	3,09E-07	3,79E-07	2,45E-07	2,26E-07	71,65
(2,1)	2,54E-09	1,72E-08	2,03E-08	3,22E-08	1,25E-07	2,14E-07	2,66E-07	1,24E-06	5,32E-06	4,48E-06	2,71E-06	2,95E-06	5,02E-06	3,11E-06	2,49E-06	2,63E-06	4,64E-07	4,46E-07	3,98E-07	4,33E-07	75,10
(2,2)	3,64E-09	2,02E-08	1,7E-08	3,41E-08	5,79E-08	1,06E-07	1,85E-07	1,43E-06	8,44E-06	3,16E-06	2,24E-06	2,12E-06	2,05E-06	1,82E-06	1,33E-06	7,91E-07	5,04E-07	5,07E-07	3,22E-07	2,55E-07	74,05
Back																					
(1,1)	2,16E-09	1,86E-08	3,21E-08	6,84E-08	3,36E-07	2,82E-07	1,29E-07	4,4E-07	3,71E-06	1,29E-06	2,63E-06	8,06E-06	9,64E-06	2,94E-06	2,63E-06	2,45E-06	7,36E-07	5,92E-07	6,69E-07	3,65E-07	75,68
(1,2)	2,69E-09	2,29E-08	4,43E-08	1,07E-07	4,07E-07	4,51E-07	1,87E-07	3,37E-07	9,06E-07	2,37E-06	2,85E-06	5,46E-06	6,34E-06	2,85E-06	2,48E-06	1,23E-06	1,27E-06	8,55E-07	3,71E-07	4,13E-07	74,62
(2,1)	1,26E-09	8,77E-09	1,04E-08	1,83E-08	7,08E-08	6,81E-08	1,03E-07	1,19E-06	1,1E-05	2,88E-06	2,45E-06	3,41E-06	5,74E-06	6,47E-06	6,15E-06	4,5E-06	9,44E-07	4,55E-07	2,36E-07	2,15E-07	76,63
(2,2)	1,9E-09	1,37E-08	1,61E-08	3,28E-08	1,05E-07	1,61E-07	1,94E-07	1,78E-06	8,06E-06	3,71E-06	3,53E-06	5,47E-06	8,42E-06	7,33E-06	4,67E-06	3,45E-06	1,1E-06	4,59E-07	3,39E-07	3,87E-07	76,92
Right																					
(1,1)	3,45E-09	2,78E-08	2,71E-08	7,02E-08	2,15E-07	2,18E-07	9,94E-08	2,5E-07	9,98E-07	2,17E-07	7,44E-07	4,47E-06	2,54E-06	9,92E-07	5,69E-07	6,16E-07	3,74E-07	2,6E-07	2,13E-07	1,57E-07	71,16
(1,2)	2,81E-09	2,78E-08	4,15E-08	7,91E-08	3,06E-07	3,7E-07	1,36E-07	2,78E-07	7,59E-07	1,07E-06	1,24E-06	3,36E-06	4,99E-06	2,43E-06	1,46E-06	1,92E-06	3,95E-07	5,03E-07	2,63E-07	2,71E-07	72,99
(2,1)	1,57E-09	1,36E-08	9,47E-09	1,96E-08	3,69E-08	3,53E-08	3,92E-08	4,54E-07	6,96E-06	1,29E-06	5,1E-07	3,28E-07	4,31E-07	5,88E-07	4,53E-07	3,01E-07	2,16E-07	1,28E-07	1,12E-07	7,07E-08	70,79
(2,2)	2E-09	1,64E-08	1,53E-08	2,08E-08	6,57E-08	1,02E-07	1,01E-07	9,6E-07	6,11E-06	3,15E-06	1,83E-06	2,55E-06	3,97E-06	2,6E-06	2,2E-06	2,14E-06	4,09E-07	3,74E-07	2,04E-07	1,94E-07	74,32
Top																					
(1,1)	2,66E-09	1,59E-08	7,15E-09	9,21E-09	5,05E-08	1,41E-07	1,98E-07	4,18E-07	1,72E-06	2,84E-06	1,13E-06	5,77E-06	2,38E-06	1,43E-06	9,15E-07	9,43E-07	4,98E-07	4,5E-07	3,32E-07	2,25E-07	72,89
(1,2)	2,08E-09	1,27E-08	5,72E-09	7,63E-09	3,85E-08	1,3E-07	1,54E-07	4,83E-07	1,03E-06	1,2E-06	5,16E-07	1,79E-06	9,8E-07	5,35E-07	2,94E-07	2,35E-07	2,31E-07	1,6E-07	9,96E-08	8,27E-08	69,02
(2,1)	2,54E-09	1,77E-08	1,45E-08	1,51E-08	1,66E-07	3,46E-07	3,76E-07	1,05E-06	2,72E-06	6,37E-06	3,15E-06	1,18E-05	6,06E-06	6,61E-06	2,95E-06	1,96E-06	1,3E-06	7,3E-07	4,44E-07	6,78E-07	76,70
(2,2)	1,89E-09	1,28E-08	1,02E-08	9,6E-09	1,08E-07	2,43E-07	2,43E-07	1,34E-06	3,95E-06	3,34E-06	3,43E-06	4,83E-06	4,72E-06	4,01E-06	3,16E-06	2,42E-06	5,46E-07	4E-07	2,34E-07	1,42E-07	75,21

Verifica dei criteri di accuratezza

$$F_2 = \overline{L_p} - \overline{L_{|I_n|}}$$

$$F_3 = \overline{L_p} - \overline{L_{I_n}}$$

$$F_4 = \frac{1}{\overline{I_n}} \sqrt{\frac{1}{N-1} \sum_{i=1}^N (I_{ni} - \overline{I_n})^2}$$

$$\overline{L_p} = 10 \log \left(\frac{1}{N} \sum_{i=1}^N 10^{0,1L_{pi}} \right)$$

$$\overline{L_{|I_n|}} = 10 \log \left(\frac{1}{N} \sum_{i=1}^N \frac{|I_{ni}|}{I_0} \right)$$

$$\overline{L_{I_n}} = 10 \log \left| \frac{1}{N} \sum_{i=1}^N \frac{I_{ni}}{I_0} \right|$$

One-third-octave band centre frequencies Hz	C Engineering (grade 2)
50 to 160	11
200 to 630	19
800 to 5 000	29
6 300	14

www.dii.unipd.it

	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
$L_{p,z}$ [dB]	64,72	70,54	66,46	66,19	68,29	66,91	64,34	69,76	76,48	71,15	68,73	71,04	70,01	68,15	66,86	64,87	60,50	58,94	57,25	58,00
$L_{ I_n ,z}$ [dB]	62,36	67,51	64,32	65,01	67,39	65,68	62,20	67,09	72,98	68,81	66,38	68,48	67,61	65,58	63,87	62,48	58,06	56,82	55,42	55,74
$F_{2,z}$ [dB]	2,36	3,03	2,15	1,18	0,90	1,23	2,14	2,67	3,50	2,34	2,35	2,55	2,40	2,57	2,99	2,40	2,44	2,13	1,83	2,26
L_d [dB]	19,57	14,15	13,44	15,14	13,85	15,74	16,05	16,84	17,93	17,95	22,05	17,38	21,2	18,01	22,98	27,71	20,98	17,06	16,15	14,84

CRITERIO 1: $L_d > F_2$	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
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	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
$L_{I_n,z}$ [dB]	62,36	67,51	64,32	65,01	67,39	65,68	62,20	67,09	72,91	68,81	66,38	68,48	67,61	65,58	63,87	62,48	58,06	56,82	55,42	55,74
$F_{3,z}$ [dB]	2,36	3,03	2,15	1,18	0,90	1,23	2,14	2,67	3,57	2,34	2,35	2,55	2,40	2,57	2,99	2,40	2,44	2,13	1,83	2,26

$(F_3 - F_2) < 3$ dB	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
----------------------	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----

	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
$I_{n,z}$ [W/m ²]	1,72E-06	5,6E-06	2,7E-06	3,2E-06	5,48E-06	3,7E-06	1,66E-06	5,12E-06	1,95E-05	7,6E-06	4,35E-06	7,05E-06	5,77E-06	3,62E-06	2,44E-06	1,77E-06	6,4E-07	4,81E-07	3,49E-07	3,75E-07
$F_{4,z}$ [dB]	0,353	0,396	0,667	0,770	0,834	0,656	0,489	0,652	0,831	0,628	0,580	0,695	0,738	0,774	0,808	0,820	0,640	0,484	0,578	0,693

CRITERIO 2: $N > C F_4^2$	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK	OK
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VERIFICA RUMORE DI FONDO	Sorgente accesa		Sorgente spenta		$L_{A,eq(on)} - L_{A,eq(off)} > 10$ dB OK
	$L_{A,eq(on)}$	74,8 dB	$L_{A,eq(off)}$	39,4 dB	

Calcolo Livelli di Potenza Sonora (pesati Z)

$$L_{w,HZ} = 10 \log \sum_{i=1}^N \frac{P_i}{10^{-12}}$$

$$L_w = 10 \log \sum_{63Hz}^{5kHz} 10^{0,1 L_{w,HZ}}$$

$$L_{w,Z,tot} = 90,3 \pm 4 \text{ dB}$$

$L_{w,Z}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	$L_{w,Z,tot}$ [dB]
	73,52	78,65	75,44	76,07	78,50	76,86	73,43	78,24	84,01	80,02	77,52	79,67	78,71	76,70	74,96	73,59	69,18	67,96	66,57	66,91	90,33
$L_{w,Z,front}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	$L_{w,Z,front}$ [dB]
	66,91	72,44	67,24	70,07	69,55	66,92	63,64	69,90	75,87	69,75	67,80	69,05	67,47	67,07	64,21	62,07	59,78	58,77	56,77	57,01	81,57
$L_{w,Z,left}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	$L_{w,Z,left}$ [dB]
	68,00	72,69	70,29	70,66	73,05	70,87	67,41	71,99	78,34	74,62	71,25	71,97	70,96	68,96	68,13	66,45	61,36	61,55	61,06	61,91	84,22
$L_{w,Z,back}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	$L_{w,Z,back}$ [dB]
	65,24	70,56	69,23	69,65	73,03	70,73	66,48	72,34	78,55	73,31	72,49	74,30	74,79	72,32	71,02	69,46	64,78	62,53	61,08	60,90	84,76
$L_{w,Z,right}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	$L_{w,Z,right}$ [dB]
	66,12	71,83	68,80	68,88	71,35	69,51	64,34	69,48	76,51	70,78	68,25	71,10	70,77	67,60	65,71	65,77	60,14	59,82	57,99	57,90	82,39
$L_{w,Z,top}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz	$L_{w,Z,top}$ [dB]
	65,82	70,22	64,84	62,28	69,00	70,25	68,47	71,78	74,54	74,58	71,05	74,64	71,50	70,40	67,65	66,25	62,82	61,21	59,45	60,02	82,99

Calcolo Livelli di Potenza Sonora (pesati A)

$$L_{w,Hz} = 10 \log \sum_{i=1}^N \frac{P_i}{10^{-12}}$$

$$L_w = 10 \log \sum_{63Hz}^{5kHz} 10^{0,1 L_{w,Hz}}$$

$$L_{w,A,tot} = 87,0 \pm 4 \text{ dB}$$

$L_{w,A}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
	47,32	56,15	56,34	59,97	65,10	65,96	64,83	71,64	79,21	76,82	75,62	78,87	78,71	77,30	75,96	74,79	70,48	69,16	67,57	67,41

$L_{w,A,tot}$ [dB]
86,99

$L_{w,A,front}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
	40,71	49,94	48,14	53,97	56,15	56,02	55,04	63,30	71,07	66,55	65,90	68,25	67,47	67,67	65,21	63,27	61,08	59,97	57,77	57,51

$L_{w,A,front}$ [dB]
77,15

$L_{w,A,left}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
	41,80	50,19	51,19	54,56	59,65	59,97	58,81	65,39	73,54	71,42	69,35	71,17	70,96	69,56	69,13	67,65	62,66	62,75	62,06	62,41

$L_{w,A,left}$ [dB]
80,31

$L_{w,A,back}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
	39,04	48,06	50,13	53,55	59,63	59,83	57,88	65,74	73,75	70,11	70,59	73,50	74,79	72,92	72,02	70,66	66,08	63,73	62,08	61,40

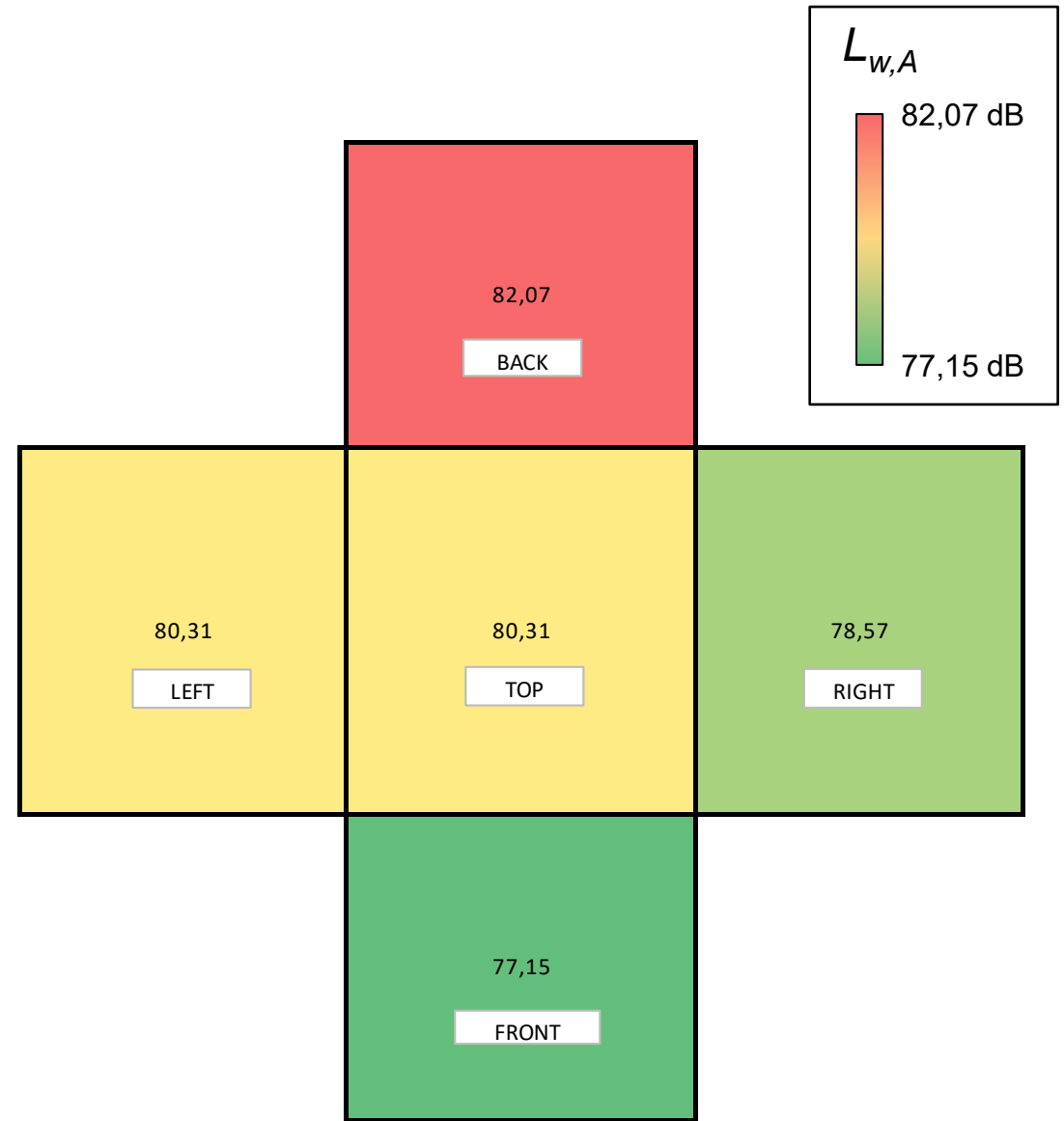
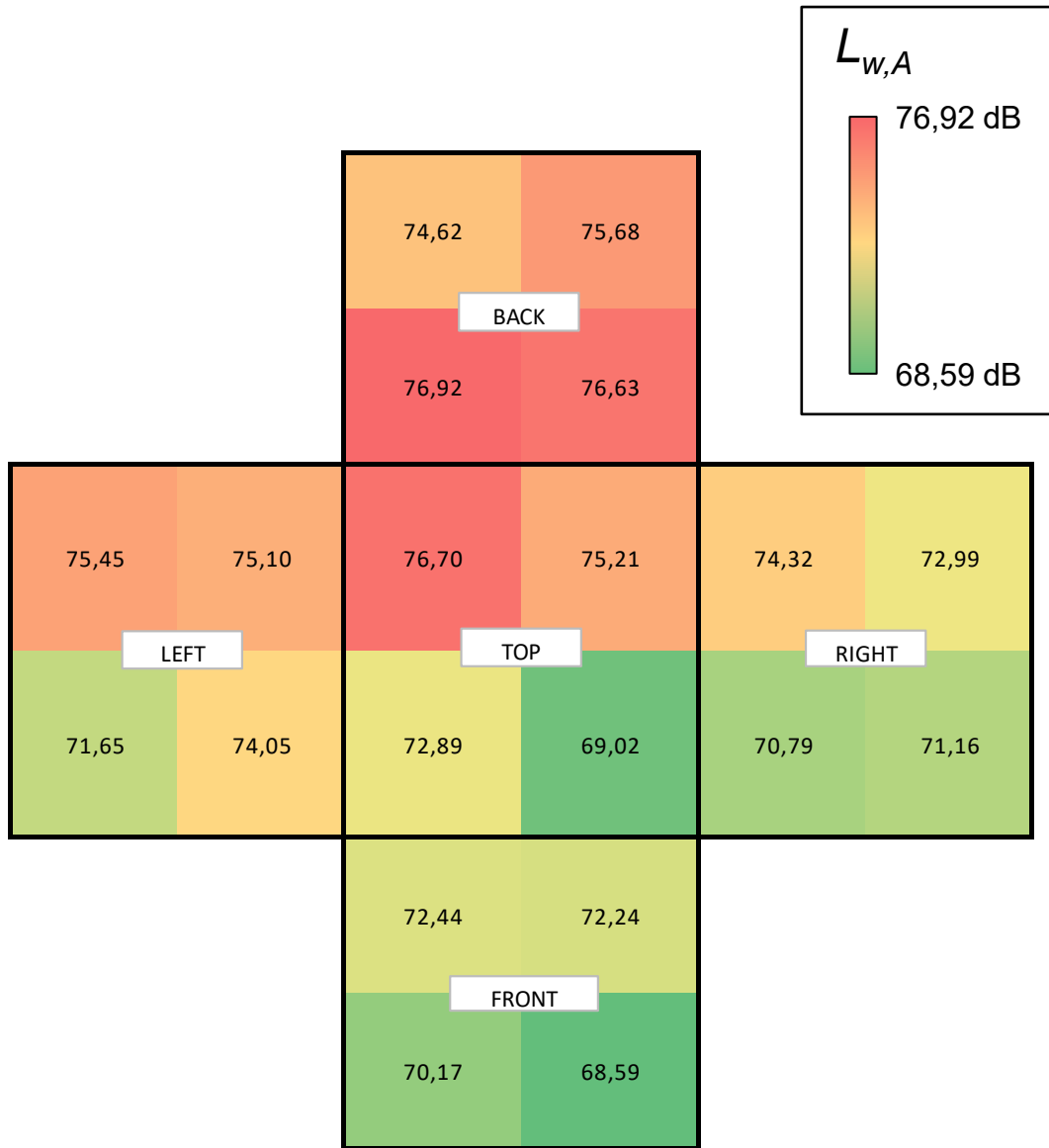
$L_{w,A,back}$ [dB]
82,07

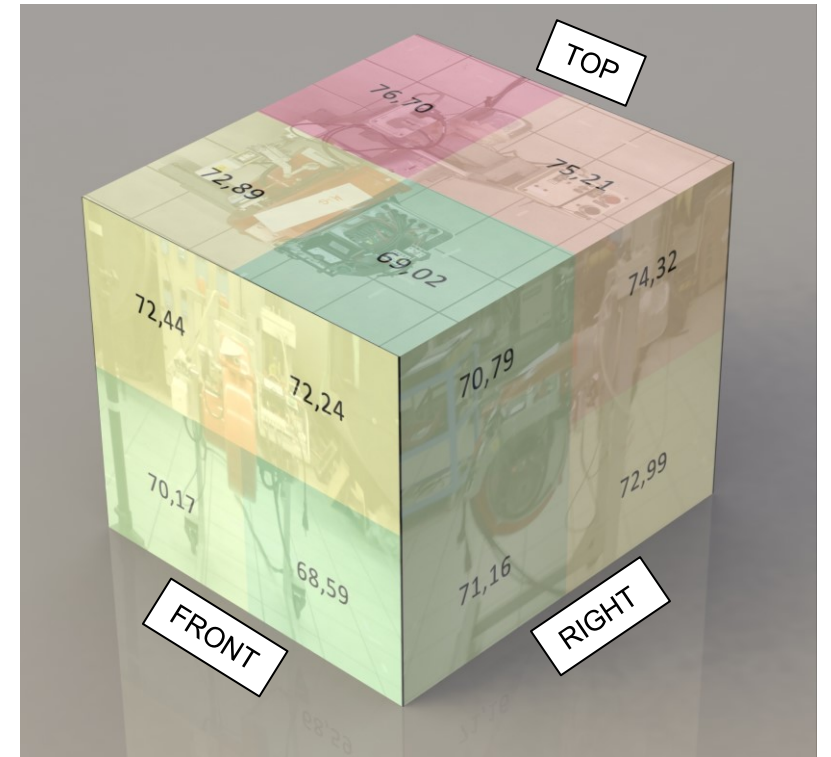
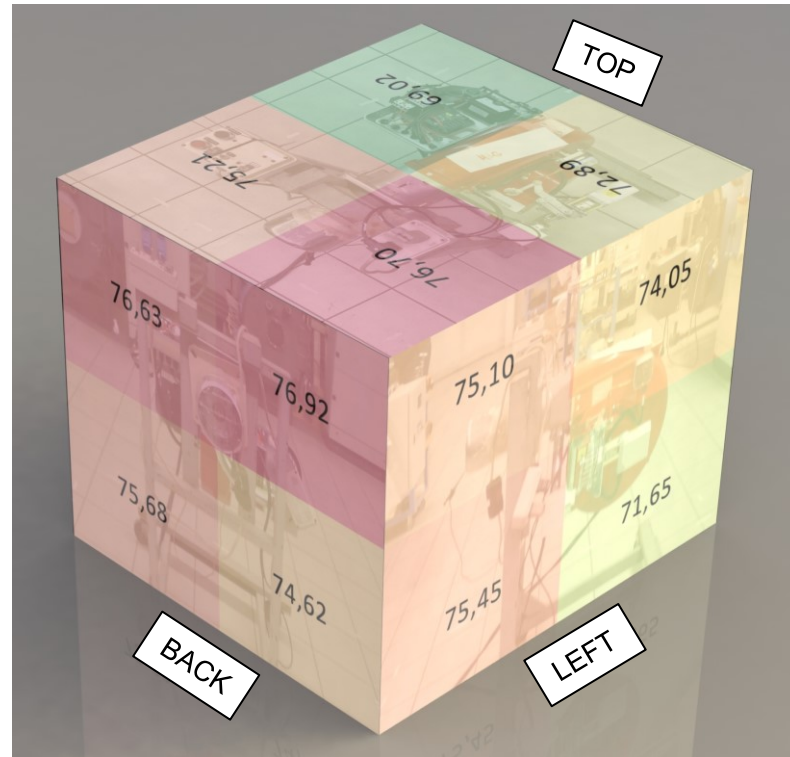
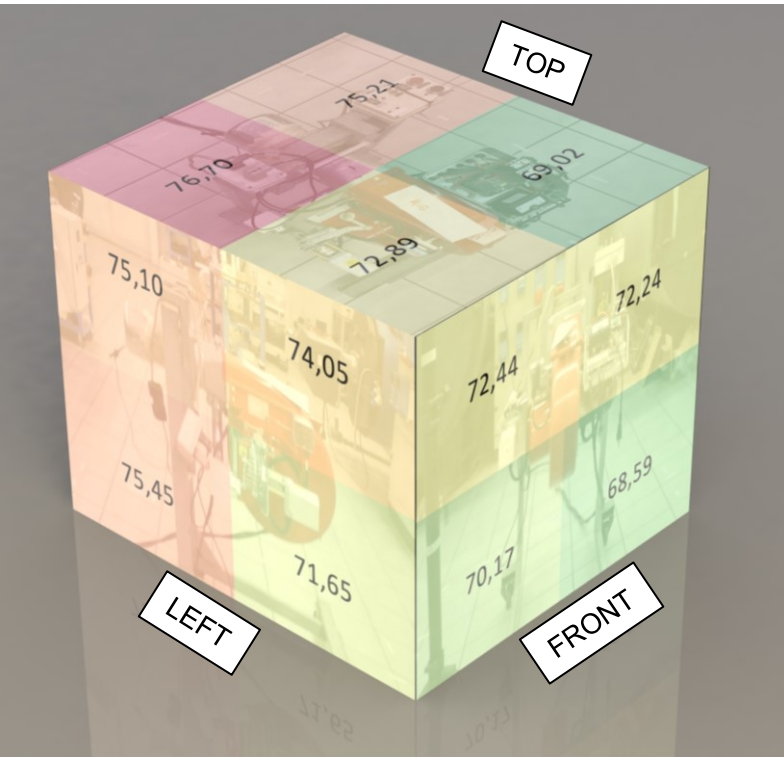
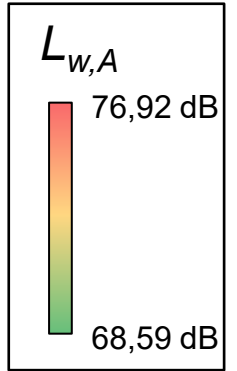
$L_{w,A,right}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
	39,92	49,33	49,70	52,78	57,95	58,61	55,74	62,88	71,71	67,58	66,35	70,30	70,77	68,20	66,71	66,97	61,44	61,02	58,99	58,40

$L_{w,A,right}$ [dB]
78,57

$L_{w,A,top}$ [dB]	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
	39,62	47,72	45,74	46,18	55,60	59,35	59,87	65,18	69,74	71,38	69,15	73,84	71,50	71,00	68,65	67,45	64,12	62,41	60,45	60,52

$L_{w,A,top}$ [dB]
80,31





Valori dei livelli di potenza sonora con le relative incertezze

La potenza sonora è riferita alla condizione di funzionamento a fiamma spenta e ventilatore alla massima potenza

$L_{w,Z,tot}$ [dB]
$90,3 \pm 4$ dB

$L_{w,A,tot}$ [dB]
$87,0 \pm 4$ dB

	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
$L_{w,Z,Hz}$ [dB]	$73,5 \pm 6$ dB	$78,6 \pm 6$ dB	$75,4 \pm 6$ dB	$76,1 \pm 6$ dB	$78,5 \pm 6$ dB	$76,9 \pm 4$ dB	$73,4 \pm 4$ dB	$78,2 \pm 4$ dB	$84,0 \pm 4$ dB	$80,0 \pm 4$ dB	$77,5 \pm 4$ dB	$79,7 \pm 3$ dB	$78,7 \pm 3$ dB	$76,7 \pm 3$ dB	$75,0 \pm 3$ dB	$73,6 \pm 3$ dB	$69,2 \pm 3$ dB	$68,0 \pm 3$ dB	$66,6 \pm 3$ dB	$66,9 \pm 3$ dB
	63Hz	80Hz	100Hz	125Hz	160Hz	200Hz	250Hz	315Hz	400Hz	500Hz	630Hz	800Hz	1kHz	1.25kHz	1.6kHz	2kHz	2.5kHz	3.15kHz	4kHz	5kHz
$L_{w,A,Hz}$ [dB]	$47,3 \pm 6$ dB	$56,1 \pm 6$ dB	$56,3 \pm 6$ dB	$60,0 \pm 6$ dB	$65,1 \pm 6$ dB	$66,0 \pm 4$ dB	$64,8 \pm 4$ dB	$71,6 \pm 4$ dB	$79,2 \pm 4$ dB	$76,8 \pm 4$ dB	$75,6 \pm 4$ dB	$78,9 \pm 3$ dB	$78,7 \pm 3$ dB	$77,3 \pm 3$ dB	$76,0 \pm 3$ dB	$74,8 \pm 3$ dB	$70,5 \pm 3$ dB	$69,2 \pm 3$ dB	$67,6 \pm 3$ dB	$67,4 \pm 3$ dB

La misura si può ritenere sufficientemente corretta, nonostante non sia stato calcolato l'indicatore F_1 .
Lo si può giustificare nel seguente modo:

- Impatto (quasi) nullo del rumore di fondo: $L_{A,eq} (ON) - L_{A,eq} (OFF) \approx 35$ dB
- La sorgente non presenta un andamento complesso del rumore
- Ambiente di misura non particolarmente riverberante

Analisi dei dati

La zona da dove si ha maggiore emissione di energia sonora è il vertice tra le facce (T), (L) e (B).

Questo punto è posto contemporaneamente ad una minore distanza dall'aspirazione dell'aria e dallo scarico dei fumi.

Per ridurre l'impatto acustico:
una volta che si sia intervenuti sulla scelta e progettazione del ventilatore, valutare l'eventuale aggiunta di materiale fonoassorbente e/o di barriere acustiche in quella direzione.

