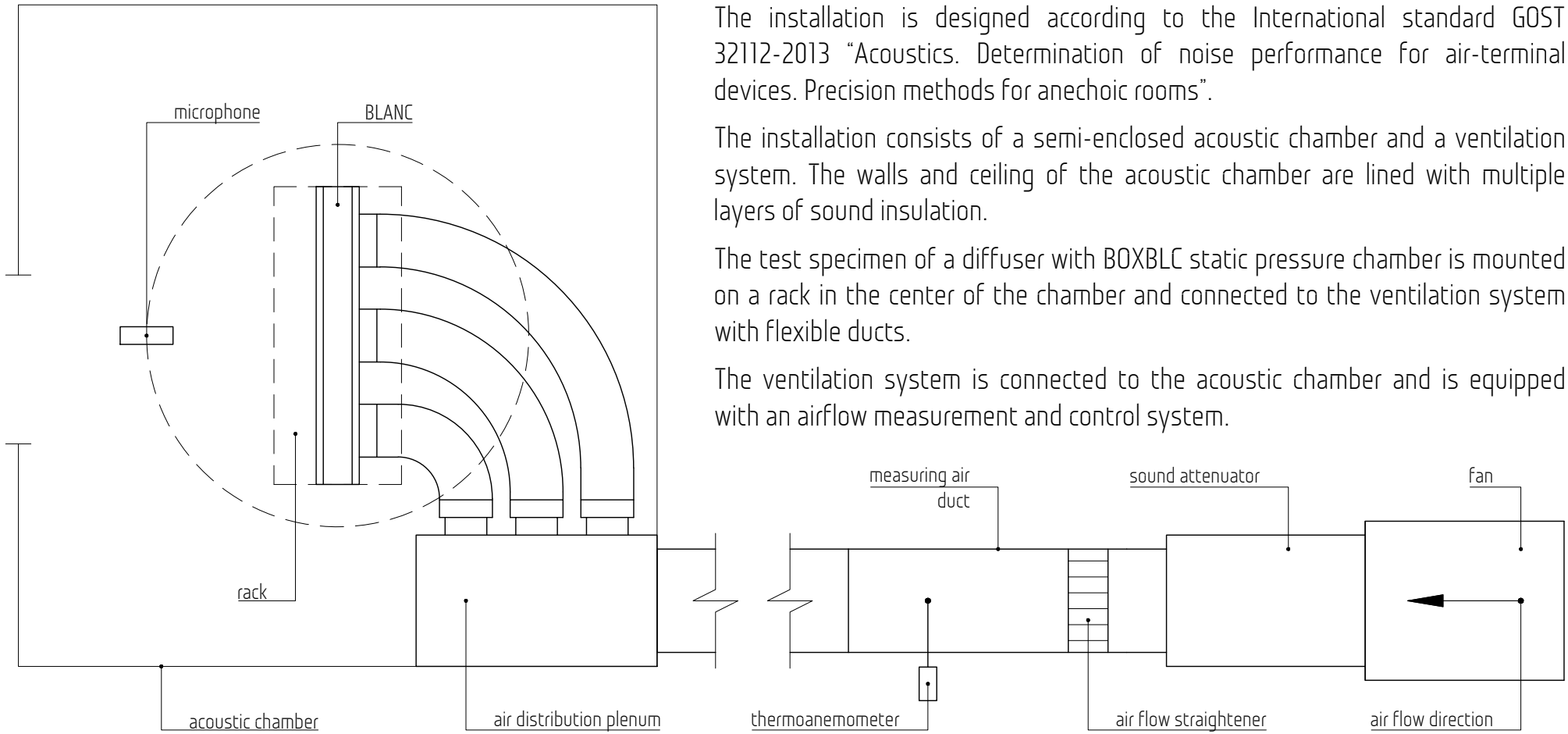
BLANC

Protocol of acoustic tests

from 19.09.2024

DESCRIPTION OF THE ACOUSTIC TEST INSTALLATION

Figure 1 - SCHEMATIC DIAGRAM OF THE INSTALLATION FOR MEASURING ACOUSTIC CHARACTERISTICS



The installation is designed according to the International standard GOST 32112-2013 "Acoustics. Determination of noise performance for air-terminal devices. Precision methods for anechoic rooms".

The installation consists of a semi-enclosed acoustic chamber and a ventilation system. The walls and ceiling of the acoustic chamber are lined with multiple layers of sound insulation.

The test specimen of a diffuser with BOXBLC static pressure chamber is mounted on a rack in the center of the chamber and connected to the ventilation system with flexible ducts.

The ventilation system is connected to the acoustic chamber and is equipped with an airflow measurement and control system.

ACOUSTIC CHAMBER

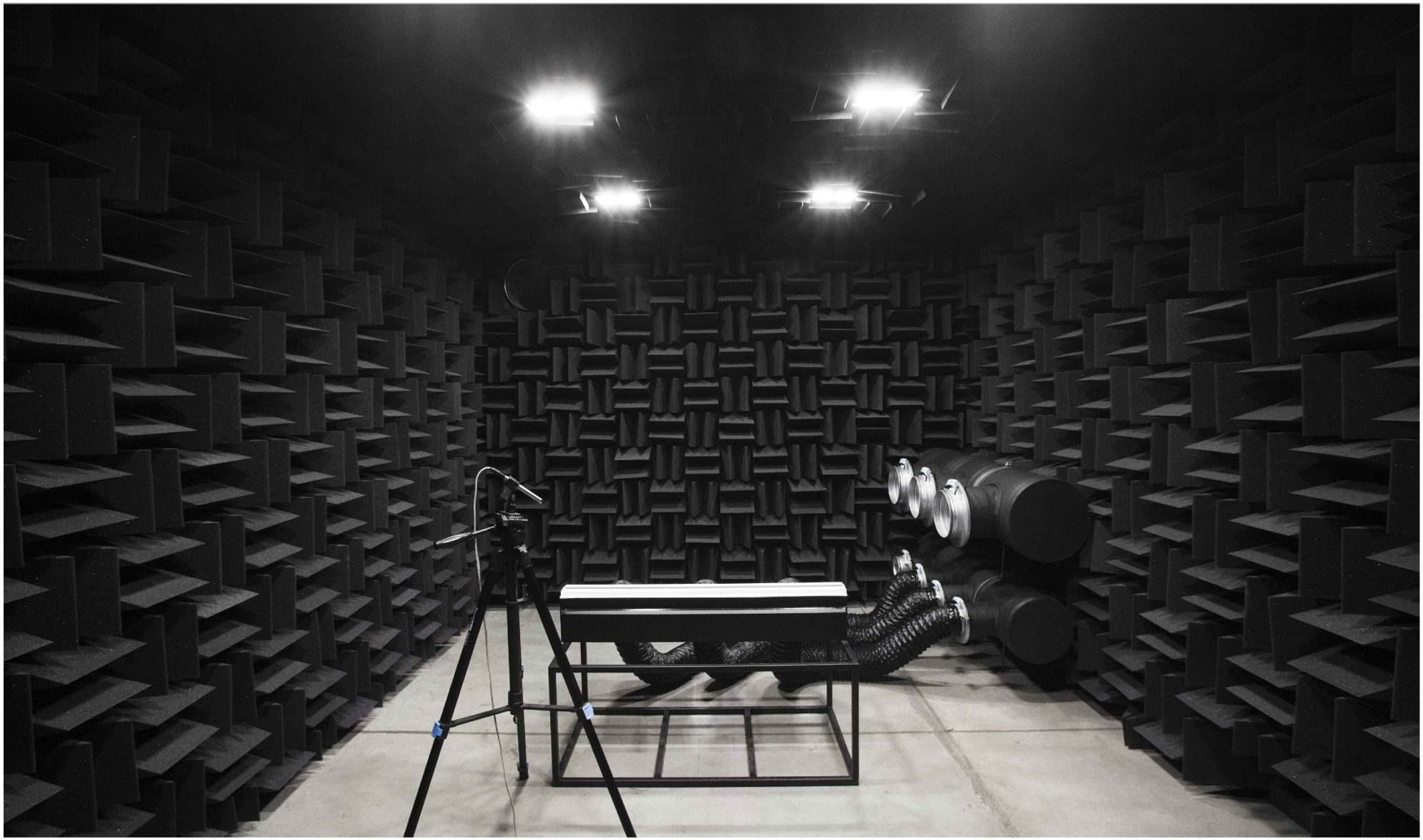


Figure 2 - ACOUSTIC CHAMBER. GENERAL VIEW

ACOUSTIC TESTING METHODICS

The test objects are diffuser specimens with a length of 1000 mm, equipped with BOXBLC plenum boxes in STD version (side spigots). The acoustic characteristics of diffusers with BOXBLC plenum boxes in different versions (STD, FRNT) may differ within ±5%.

In preparation for testing, the diffuser with BOXBLC plenum box is mounted in the center of the acoustic chamber on a rack and connected to the ventilation system using flexible ducts.

During the test, the installation is adjusted to the specified air flow rate. Once steady-state air flow rate is reached, the sound pressure level and air flow rate are measured to provide a point on the graphic. The measurements are then repeated at other flow rates.

Measured parameters:

- q_v - air flow rate [m^3/h];
- L_{eqA} - sound pressure level with correction A [dB(A)];
- L_{eq} - sound pressure level [dB];
- $T_{изм}$ - air temperature [°C];
- $Ф_{отн}$ - relative humidity [%];
- $B_{изм}$ - atmospheric pressure [Pa].

The test results are processed using the least squares method (see page 4). An average curve is plotted over the measured values of air flow rate and sound pressure level. The sound power is then calculated using the formulas:

$$L_{wA} = L_{pf} + 10 \log\left(\frac{S_k}{S_0}\right) + C_1 + C_2$$

$$C_1 = -10 \log\left[\frac{B_{изм}}{B_0} \times \sqrt{\frac{313{,}15}{273{,}15 + T_{изм}}}\right]$$

$$C_2 = -15 \log\left[\frac{B_{изм}}{B_0} \times \sqrt{\frac{296{,}15}{273{,}15 + T_{изм}}}\right]$$

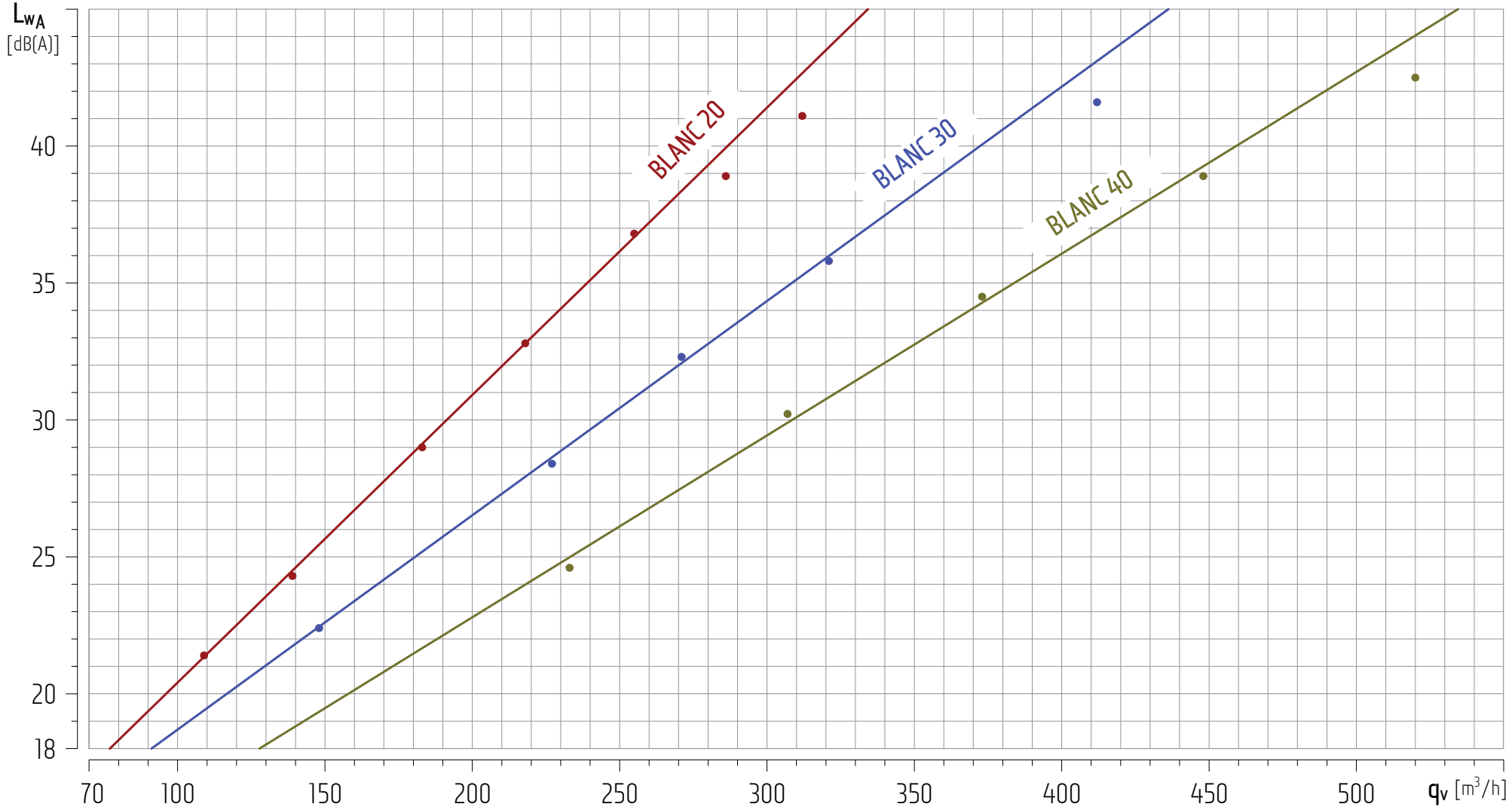
Table 1 - MEASURING INSTRUMENTS

№	Measured parameter	Measuring instrument (QR code on FGIS "Arshin")	
1	Air flow velocity	Thermo-anemometer TTM-2-01 T	
2	Sound pressure level	Noise meter Oktava-111	
3	Temperature, relative humidity, atmospheric pressure	Thermo-hygrometer ИВТМ-7 М 5-Д	

L_{wA} – sound power level [dB(A)]; L_{pf} – average sound pressure level at the measuring hemisphere [dB(A)]; S_k – area of the measuring hemisphere [m^2]; S_0 – reference area [m^2]; C_1, C_2 – reference area [dB]; B_0 – atmospheric pressure under normal conditions [Pa].

ACOUSTIC TEST RESULTS FOR BLANC 20-40

Figure 3 - PRESSURE VS. AIR FLOW RATE GRAPHIC



q_v - volume flow rate [m^3/h]; L_{wA} - sound pressure level with correction A [dB(A)].

ACOUSTIC TEST RESULTS FOR BLANC 20-40

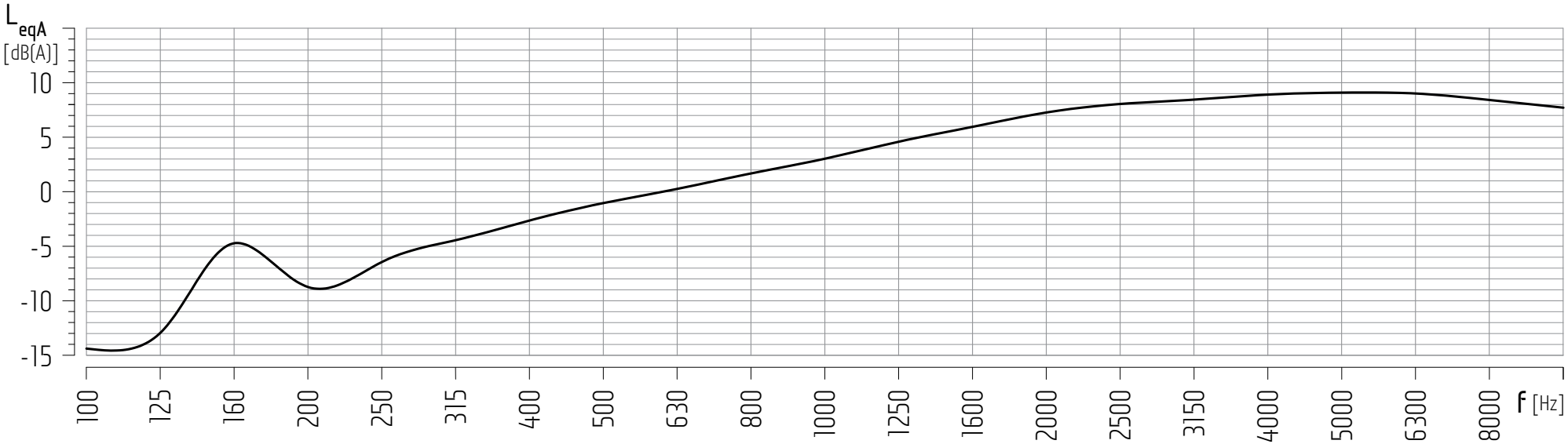
Table 2 - RESULTS OF THE SOUND POWER CALCULATION

	BLANC 20						BLANC 30						BLANC 40					
№	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
q_v [m^3/h]	77	109	139	183	218	255	118	148	227	271	321	412	155	233	307	373	448	520
L_{eqA} [dB(A)]	18,8	19,6	22,5	27,2	31,0	35,0	19,0	20,6	26,6	30,5	34,0	39,8	19,7	22,8	28,4	32,7	37,1	40,7
L_{wA} [dB(A)]	20,6	21,4	24,3	29,0	32,8	36,8	20,8	22,4	28,4	32,3	35,8	41,6	21,5	24,6	30,2	34,5	38,9	42,5

Table 3 - BACKGROUND NOISE SPECTRUM IN ACOUSTIC CAMERA

f [Гц]	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
L_{eqA} [dB(A)]	-14,4	-13,0	-4,8	-8,8	-6,5	-4,5	-2,7	-1,1	0,2	1,6	3,0	4,5	5,9	7,2	8,0	8,4	8,9	9,0	9,0	8,4	7,7

Figure 4 - GRAPHIC OF THE BACKGROUND NOISE SPECTRUM IN ACOUSTIC CAMERA



q_v - volume flow rate [m^3/h]; L_{eqA} - sound pressure level with correction A [dB(A)]; L_{wA} – sound power level A [dB(A)]; f - third-octave band with geometric mean frequency [Hz]; L_{eq} - sound pressure level [dB].

ACOUSTIC TEST RESULTS FOR BLANC 20-40

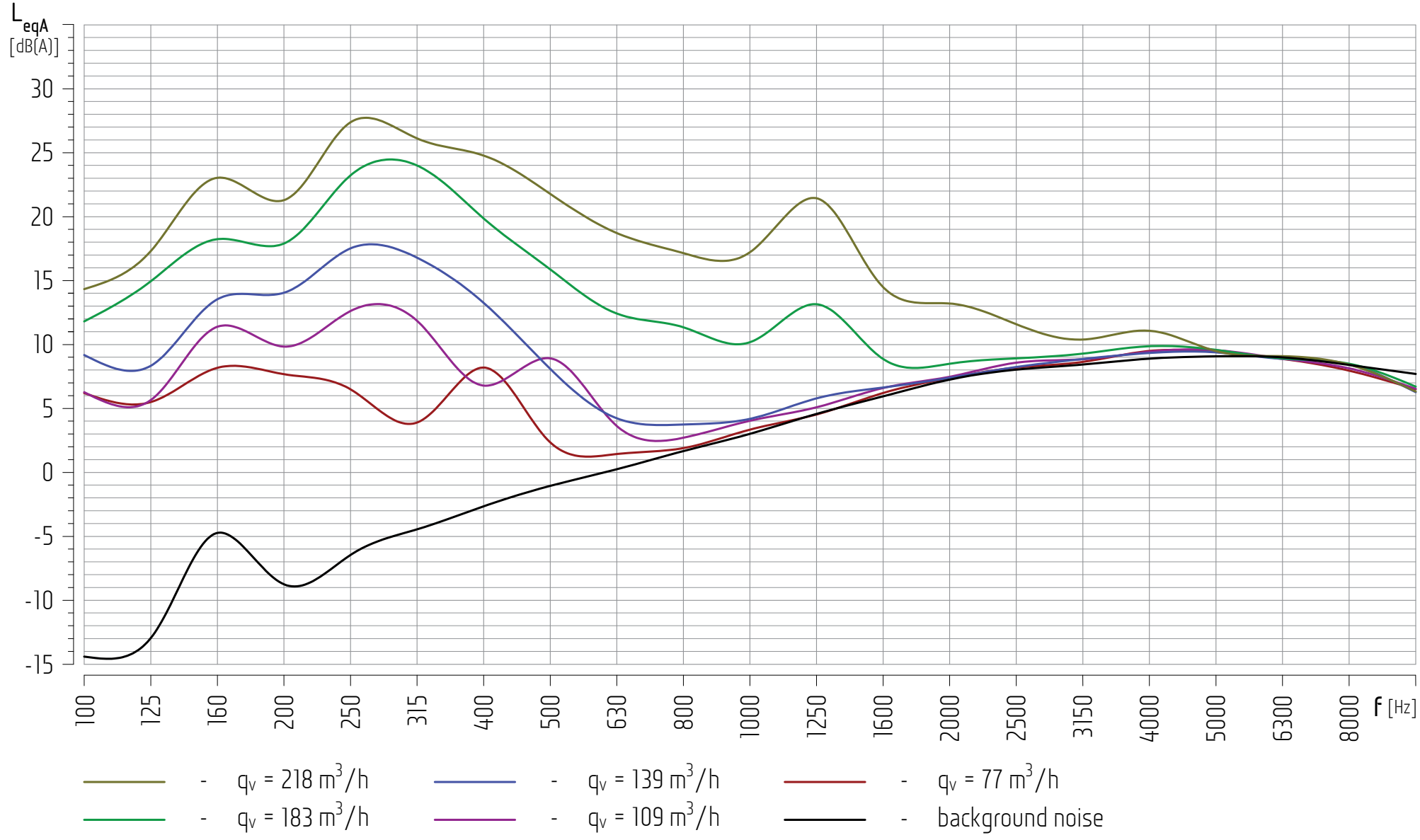
Table 4 - NOISE SPECTERS FOR BLANC 20, 30, 40 DIFFUSORS

	f [Hz]	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
	q_v [m^3/h]	L_{eqA} [dB(A)]																				
BLANC 20	77	6,20	5,50	8,18	7,68	6,50	3,90	8,20	2,35	1,44	1,90	3,35	4,53	6,21	7,38	8,20	8,64	9,50	9,42	8,88	7,96	6,50
	109	6,27	5,66	11,39	9,84	12,62	11,85	6,79	8,92	3,63	2,71	4,04	5,09	6,60	7,48	8,58	8,85	9,44	9,56	8,90	8,14	6,54
	139	9,18	8,34	13,54	14,05	17,52	16,79	13,26	8,10	4,23	3,75	4,19	5,79	6,64	7,40	8,24	8,87	9,34	9,39	8,88	8,43	6,27
	183	11,81	14,95	18,24	17,90	23,23	24,00	19,86	15,88	12,42	11,35	10,18	13,15	8,87	8,50	8,92	9,29	9,87	9,58	8,92	8,50	6,71
	218	14,33	17,31	23,04	21,29	27,38	26,12	24,78	21,78	18,72	17,15	17,22	21,44	14,49	13,21	11,59	10,39	11,08	9,49	9,09	8,43	6,33
BLANC 30	118	7,77	6,27	9,60	7,78	8,75	8,19	6,87	7,59	3,99	2,53	3,75	4,97	6,58	7,62	8,37	8,75	9,64	9,42	8,80	8,03	6,51
	148	7,73	8,76	11,11	10,35	13,11	11,28	8,03	7,46	6,76	3,13	3,72	5,15	6,85	7,74	8,22	8,98	9,62	9,34	9,10	7,99	6,51
	227	11,64	14,03	16,37	16,93	23,23	23,13	20,28	15,21	9,98	8,42	7,98	11,17	7,89	8,45	8,70	9,07	9,90	9,30	8,83	8,19	6,47
	271	13,55	18,03	20,11	21,43	27,27	28,01	24,43	21,18	16,51	14,86	14,51	18,72	11,78	10,65	10,42	9,93	9,99	9,84	9,06	8,40	6,48
	321	17,56	20,69	23,95	24,14	30,48	30,17	27,66	24,81	21,23	20,61	20,67	25,38	16,78	14,92	12,64	11,18	10,87	10,6	9,11	8,32	6,53
BLANC 40	155	6,97	6,81	11,10	7,92	9,55	10,43	8,75	11,85	6,56	4,05	5,24	5,61	7,41	8,11	8,64	9,10	9,70	9,39	9,04	8,23	6,35
	233	9,27	9,91	13,33	12,22	16,66	17,41	14,86	8,79	5,32	3,93	4,54	6,36	7,37	7,84	8,94	9,25	9,92	9,43	9,01	8,04	6,38
	307	12,86	15,02	17,67	17,81	24,07	25,38	22,70	18,31	12,93	11,89	10,20	13,46	9,28	8,69	9,37	9,67	10,11	9,61	8,97	8,24	6,40
	373	16,54	18,71	21,92	21,20	28,04	29,13	27,10	23,72	18,86	18,84	17,67	21,47	14,42	11,91	10,82	10,18	10,46	9,73	8,91	8,50	6,38
	448	19,29	23,15	27,72	25,89	32,06	33,64	31,58	28,20	25,06	25,01	24,65	29,75	21,90	19,18	15,19	13,00	11,90	10,51	9,31	8,21	6,63

q_v - volume flow rate [m^3/h]; L_{eqA} - sound pressure level with correction A [dB(A)]; **f** - third-octave band with geometric mean frequency [Hz].

ACOUSTIC TEST RESULTS FOR BLANC 20-40

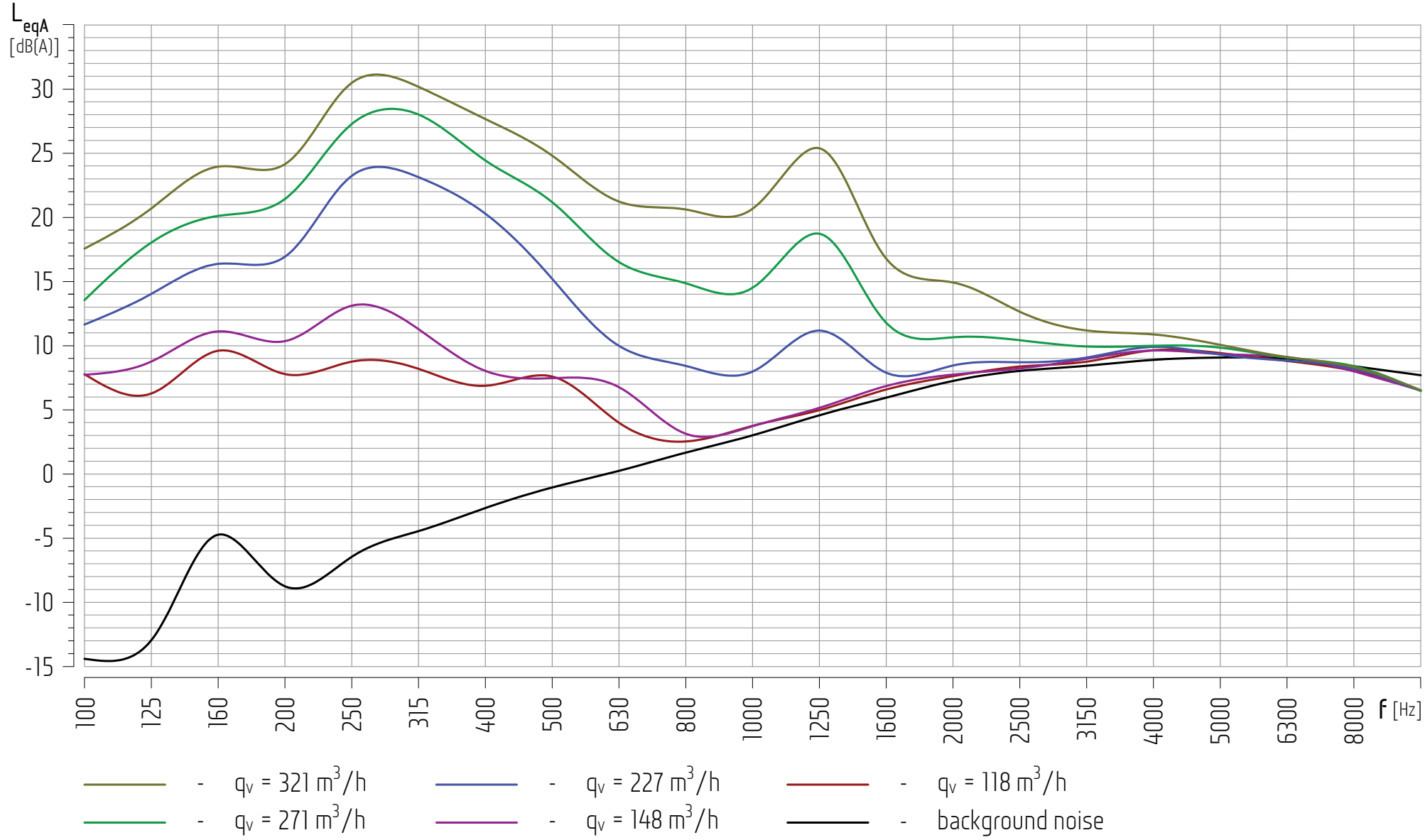
Figure 5 - GRAPHIC OF THE NOISE SPECTERS FOR BLANC 20 DIFFUSORS



q_v - volume flow rate [m³/h]; **L_{eqA}** - sound pressure level with correction A [dB(A)]; **f** - third-octave band with geometric mean frequency [Hz].

ACOUSTIC TEST RESULTS FOR BLANC 20-40

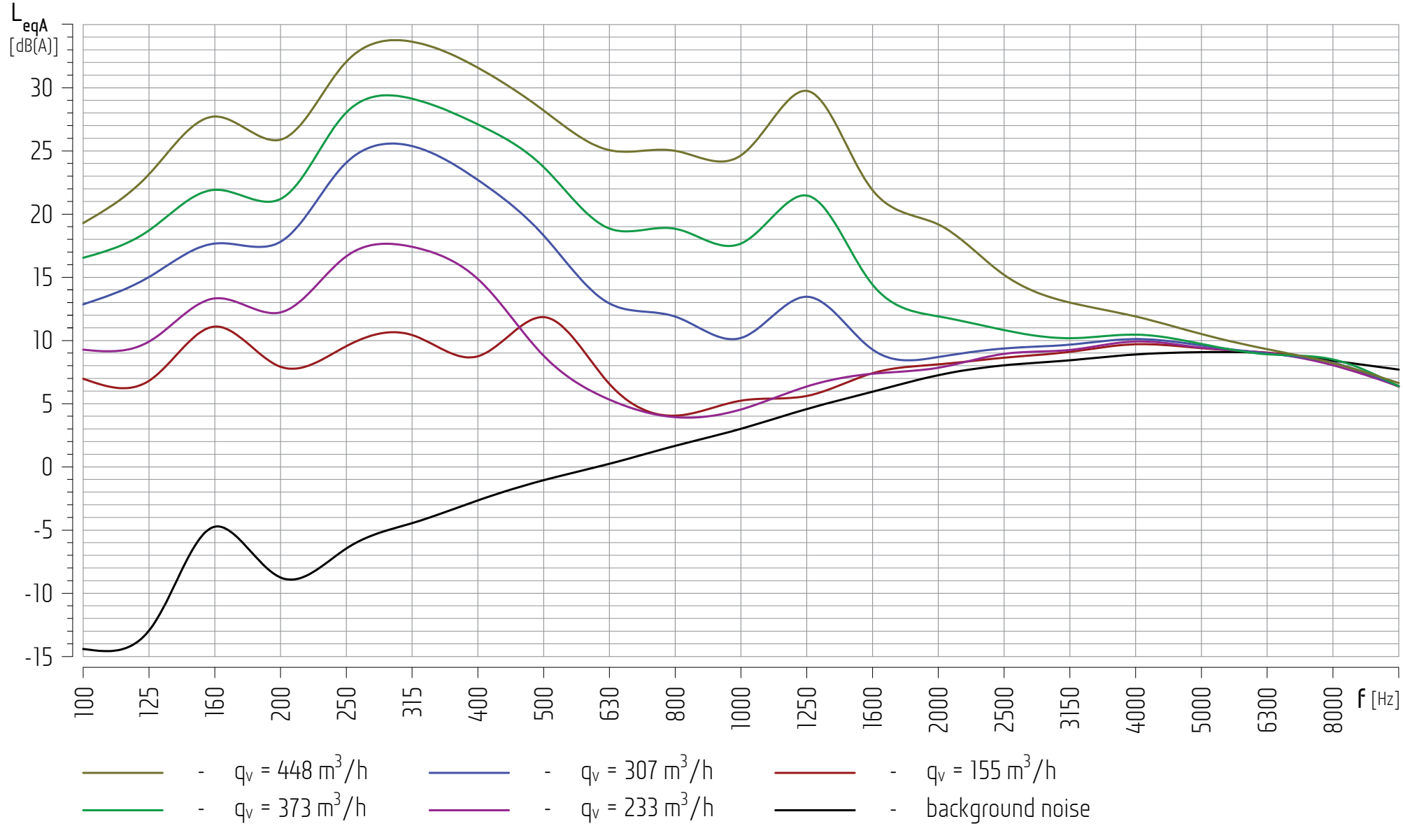
Figure 6 - GRAPHIC OF THE NOISE SPECTERS FOR BLANC 30 DIFFUSORS



q_v - volume flow rate [m³/h]; **L_{eqA}** - sound pressure level with correction A [dB(A)]; **f** - third-octave band with geometric mean frequency [Hz].

ACOUSTIC TEST RESULTS FOR BLANC 20-40

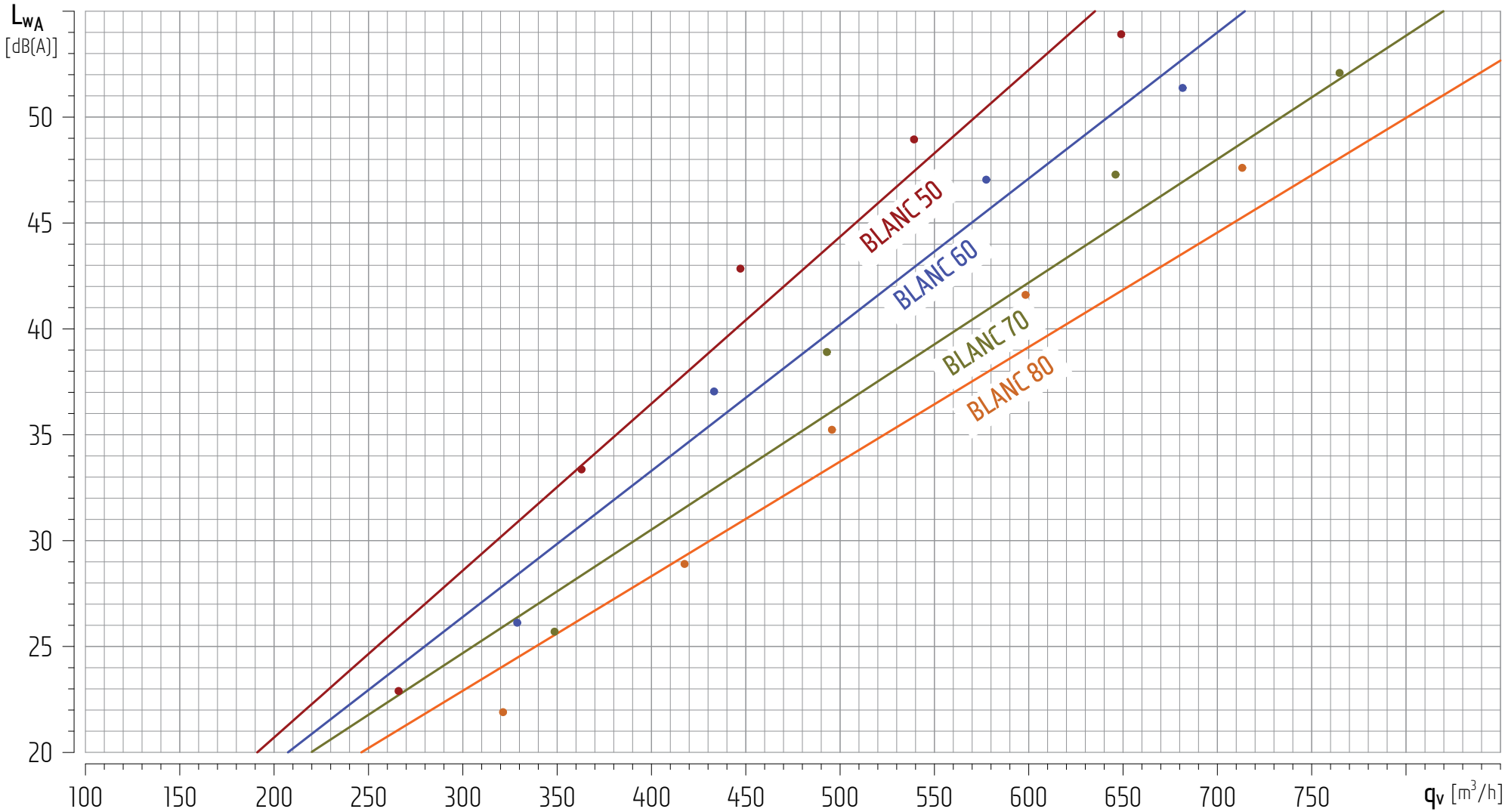
Figure 7 - GRAPHIC OF THE NOISE SPECTERS FOR BLANC 40 DIFFUSORS



q_v - volume flow rate [m³/h]; **L_{eqA}** - sound pressure level with correction A [dB(A)]; **f** - third-octave band with geometric mean frequency [Hz].

ACOUSTIC TEST RESULTS FOR BLANC 50-80

Figure 8 - PRESSURE VS. AIR FLOW RATE GRAPHIC



q_v - volume flow rate [m³/h]; L_{wA} - sound pressure level with correction A [dB(A)].

ACOUSTIC TEST RESULTS FOR BLANC 50-80

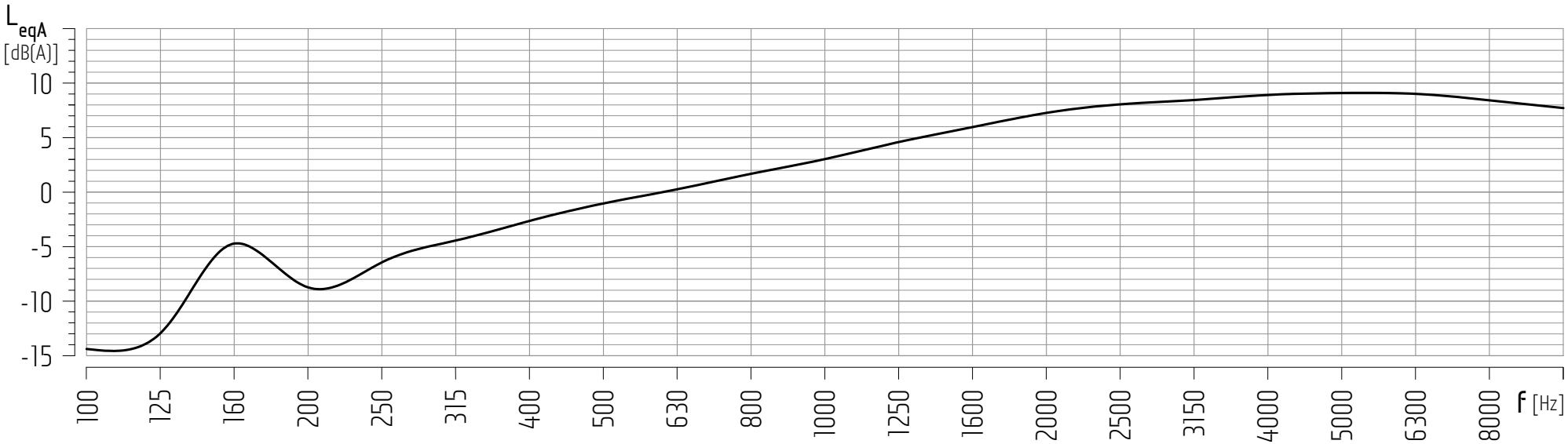
Table 5 - RESULTS OF THE SOUND POWER CALCULATION

	BLANC 50						BLANC 60						BLANC 70						BLANC 80					
№	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
q_v [m³/h]	179	261	360	447	539	649	228	329	433	578	682	733	240	349	412	493	646	765	264	321	418	496	598	713
L_{eqA} [dB(A)]	17,7	21,0	31,4	40,9	46,9	52,0	17,8	24,2	35,1	45,1	49,4	53,0	17,6	23,6	29,4	36,8	45,2	50,0	17,7	19,9	26,9	33,1	39,5	45,5
L_{wA} [dB(A)]	19,6	23,0	33,4	42,8	48,9	53,9	19,8	26,1	37,0	47,0	51,4	55,0	19,7	25,7	31,5	38,9	47,3	52,1	19,8	58,4	34,6	62,6	41,3	45,5

Table 6 - BACKGROUND NOISE SPECTRUM IN ACOUSTIC CAMERA

f [Hz]	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
L_{eqA} [dB(A)]	-14,4	-13,0	-4,8	-8,8	-6,5	-4,5	-2,7	-1,1	0,2	1,6	3,0	4,5	5,9	7,2	8,0	8,4	8,9	9,0	9,0	8,4	7,7

Table 9 - GRAPHIC OF THE BACKGROUND NOISE SPECTRUM IN ACOUSTIC CAMERA



q_v - volume flow rate [m³/h]; L_{eqA} - sound pressure level with correction A [dB(A)]; L_{wA} – sound power level A [dB(A)]; **f** - third-octave band with geometric mean frequency [Hz]; L_{eq} - sound pressure level [dB].

ACOUSTIC TEST RESULTS FOR BLANC 50-80

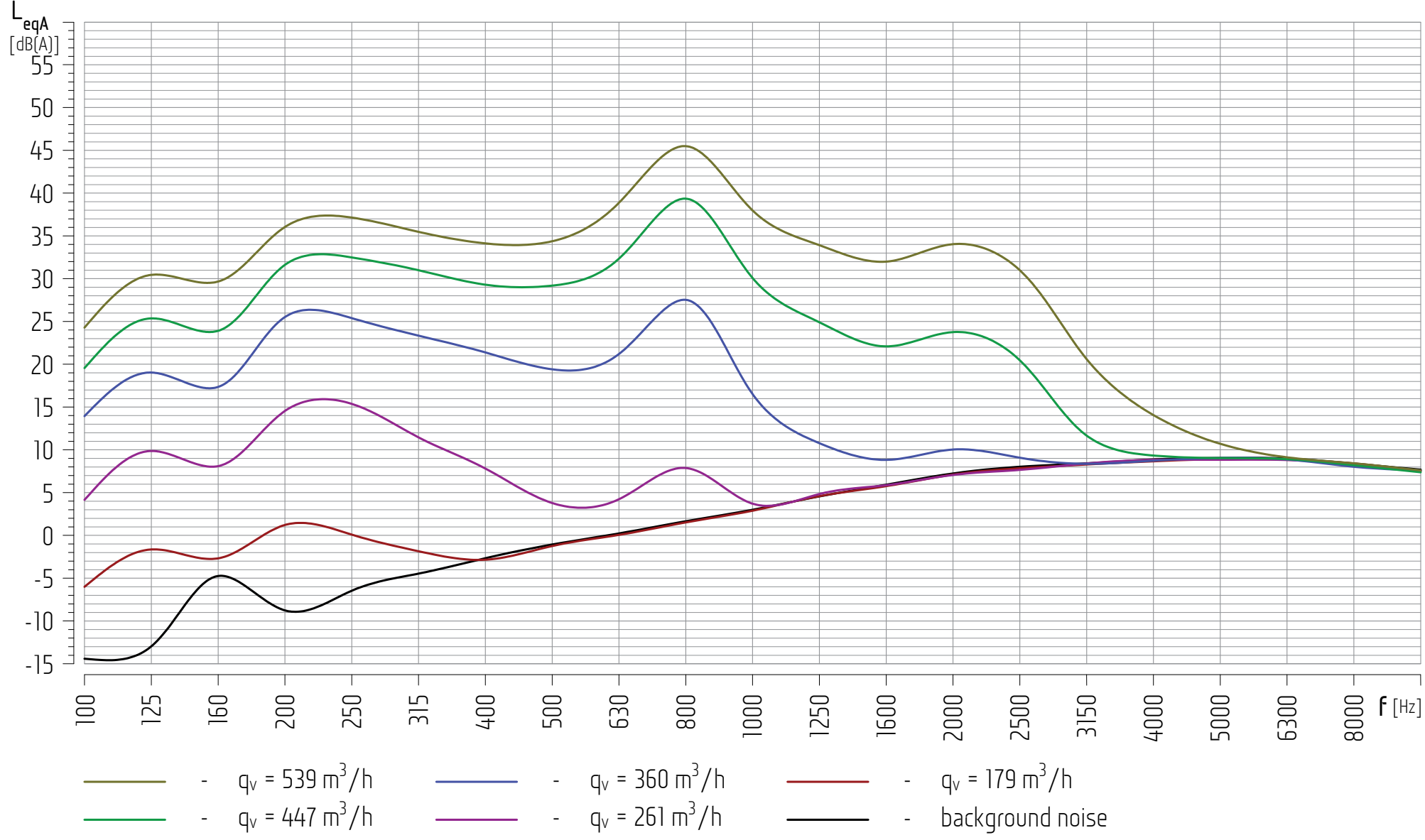
Table 7 - NOISE SPECTERS FOR BLANC 50, 60, 70, 80

	f [Hz]	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
	q_v [m^3/h]	L_{eqA} [dB(A)]																				
BLANC 50	179	-6,01	-1,64	-2,68	1,22	0,09	-1,85	-2,84	-1,24	0,06	1,52	2,89	4,59	5,76	7,11	7,85	8,29	8,67	8,91	8,84	8,42	7,51
	261	4,15	9,87	8,10	14,55	15,38	11,46	7,82	3,79	4,23	7,88	3,71	4,84	5,87	7,07	7,66	8,41	8,84	8,84	8,82	8,28	7,57
	360	13,95	19,04	17,36	25,53	25,40	23,35	21,39	19,42	21,21	27,54	16,52	10,78	8,83	10,04	9,08	8,37	8,74	9,05	8,88	8,02	7,60
	447	19,56	25,37	23,92	31,63	32,50	31,00	29,31	29,20	32,36	39,37	30,09	24,92	22,10	23,77	20,47	11,67	9,34	9,04	8,92	8,21	7,38
	539	24,30	30,46	29,68	36,06	37,16	35,49	34,14	34,39	38,89	45,51	37,99	33,93	32,01	34,05	31,00	20,61	14,07	10,71	9,13	8,42	7,59
BLANC 60	228	-4,75	0,77	1,13	4,09	3,75	0,39	0,54	0,03	0,23	1,66	2,78	4,35	5,73	6,88	7,76	8,26	8,73	8,80	8,74	8,17	7,41
	329	8,32	12,77	12,86	18,26	19,54	16,69	12,54	12,20	10,11	13,74	6,26	5,37	6,06	7,23	8,03	8,38	9,09	8,98	8,79	8,22	7,42
	433	15,82	21,43	22,01	27,40	29,04	26,67	24,46	25,06	26,09	31,69	22,14	17,96	14,64	17,14	15,42	9,18	8,91	8,83	8,78	8,25	7,38
	578	23,14	29,27	29,61	34,69	36,59	34,61	32,55	33,73	36,99	42,97	35,39	32,30	29,54	32,38	30,37	20,93	15,25	10,40	9,07	8,28	7,45
	682	26,60	32,93	33,21	38,70	40,32	37,98	35,89	37,06	40,97	47,16	40,38	37,82	36,12	38,96	36,54	27,84	22,45	15,10	10,98	8,66	7,54
BLANC 70	240	-6,55	-2,14	-2,08	-0,11	0,61	-3,11	-2,68	-1,08	0,22	1,61	3,02	4,56	5,85	7,06	7,93	8,40	8,93	9,03	8,90	8,39	7,57
	412	14,51	17,40	16,73	21,89	25,05	23,41	20,07	18,78	18,33	23,50	13,67	8,76	7,17	8,10	8,16	8,43	8,88	8,97	8,94	8,39	7,68
	646	21,32	27,56	28,53	33,85	36,83	35,04	32,53	33,31	36,19	43,94	36,09	32,36	28,80	31,24	27,50	19,16	13,23	9,71	9,11	8,37	7,65
	765	25,65	31,89	32,13	37,72	40,55	38,71	36,12	37,05	40,68	48,47	41,75	38,83	36,80	39,62	36,13	28,86	22,38	14,52	10,82	8,82	7,71
	886	29,84	35,90	35,96	41,35	44,35	42,32	39,46	40,13	43,86	51,64	46,05	43,59	42,73	46,48	43,11	36,32	30,77	22,51	16,66	11,64	8,78
BLANC 80	321	5,95	6,75	5,86	11,31	13,26	10,22	4,89	2,10	1,80	3,91	3,24	4,58	6,07	7,30	8,36	9,28	9,43	9,30	8,98	8,43	7,62
	418	13,33	15,38	14,32	19,73	22,33	20,71	17,72	15,52	14,62	19,82	10,50	6,77	6,36	7,70	7,99	8,43	8,87	8,97	8,92	8,34	7,61
	598	15,79	22,64	23,29	29,30	31,82	30,34	28,06	28,58	30,70	38,28	29,10	23,93	19,32	21,69	16,73	11,46	9,22	9,08	8,95	8,37	7,55
	713	20,84	26,68	27,52	33,52	36,28	34,41	32,65	33,28	36,53	44,63	36,89	32,72	29,03	31,36	27,08	20,77	13,42	9,93	9,13	8,37	7,58
	853	25,62	31,45	31,72	37,70	40,54	38,70	36,14	37,33	41,15	49,23	42,97	39,79	37,51	39,90	35,81	30,07	22,60	15,48	11,43	9,22	7,83

q_v - volume flow rate [m^3/h]; L_{eqA} - sound pressure level with correction A[dB(A)]; f - third-octave band with geometric mean frequency [Hz].

ACOUSTIC TEST RESULTS FOR BLANC 50-80

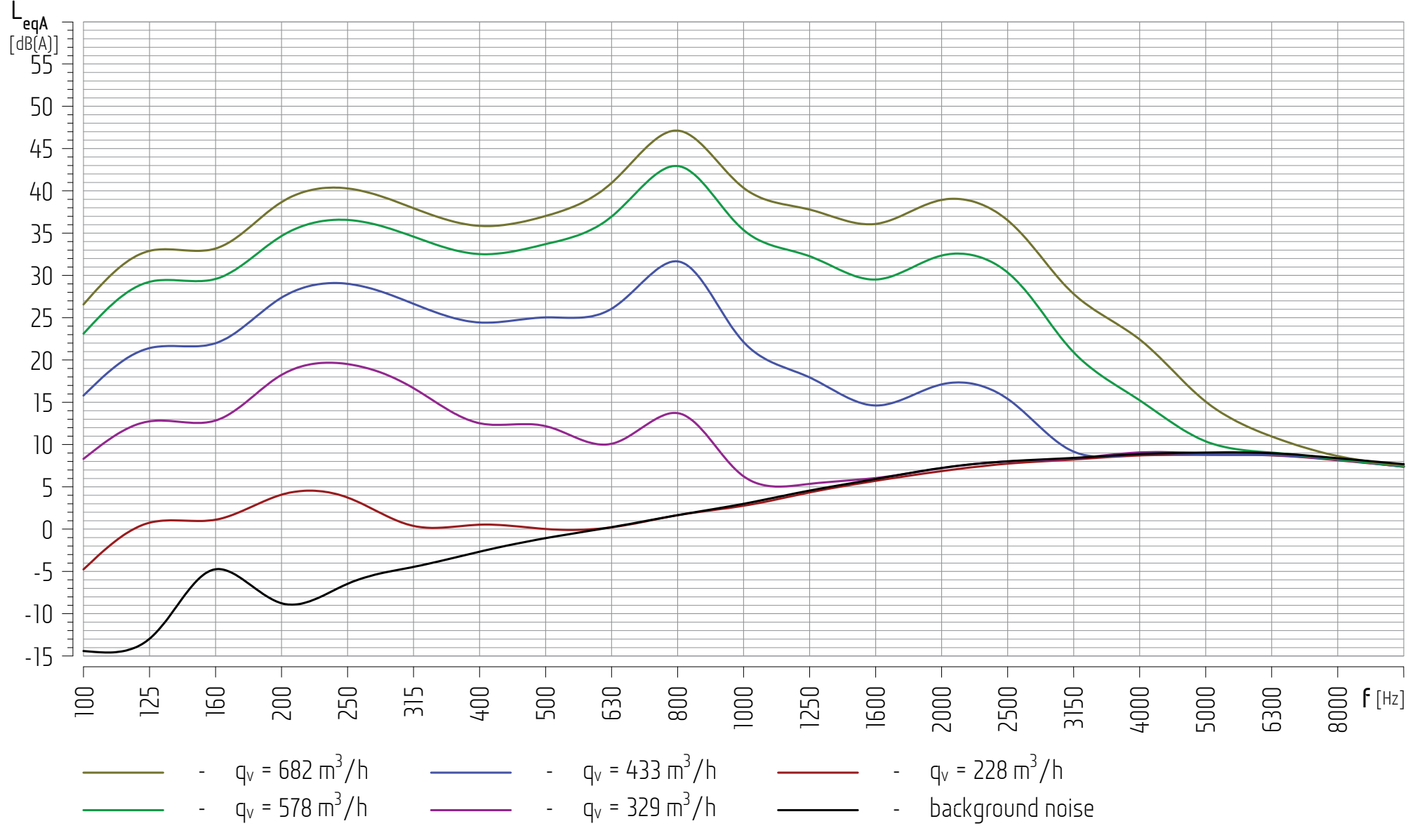
Figure 10 - GRAPHIC OF THE NOISE SPECTERS FOR BLANC 50 DIFFUSORS



q_v - volume flow rate [m³/h]; **L_{eqA}** - sound pressure level with correction A [dB(A)]; **f** - third-octave band with geometric mean frequency [Hz].

ACOUSTIC TEST RESULTS FOR BLANC 50-80

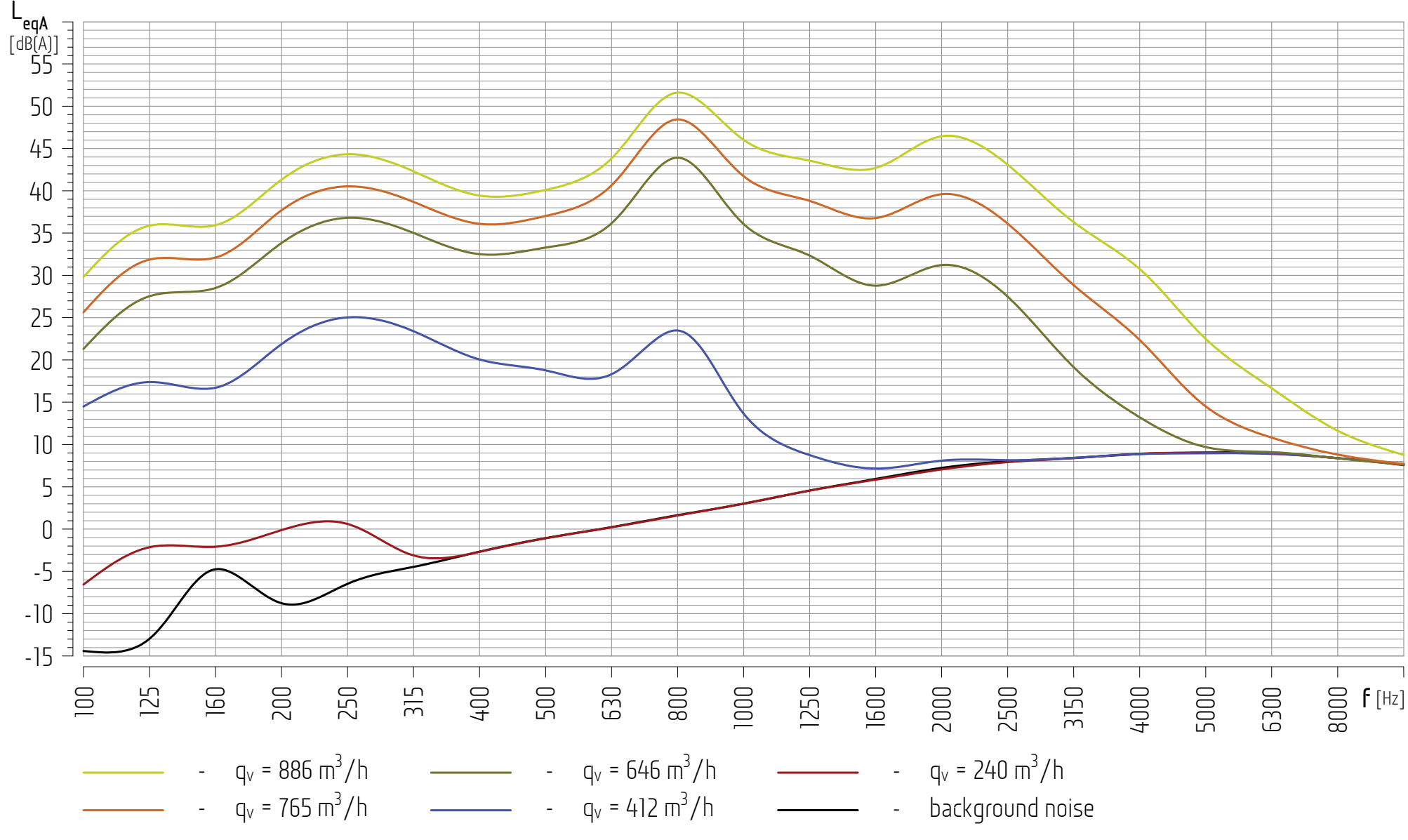
Figure 11 - GRAPHIC OF THE NOISE SPECTERS FOR BLANC 60 DIFFUSORS



q_v - volume flow rate [m³/h]; **L_{eqA}** - sound pressure level with correction A [dB(A)]; **f** - third-octave band with geometric mean frequency [Hz].

ACOUSTIC TEST RESULTS FOR BLANC 50-80

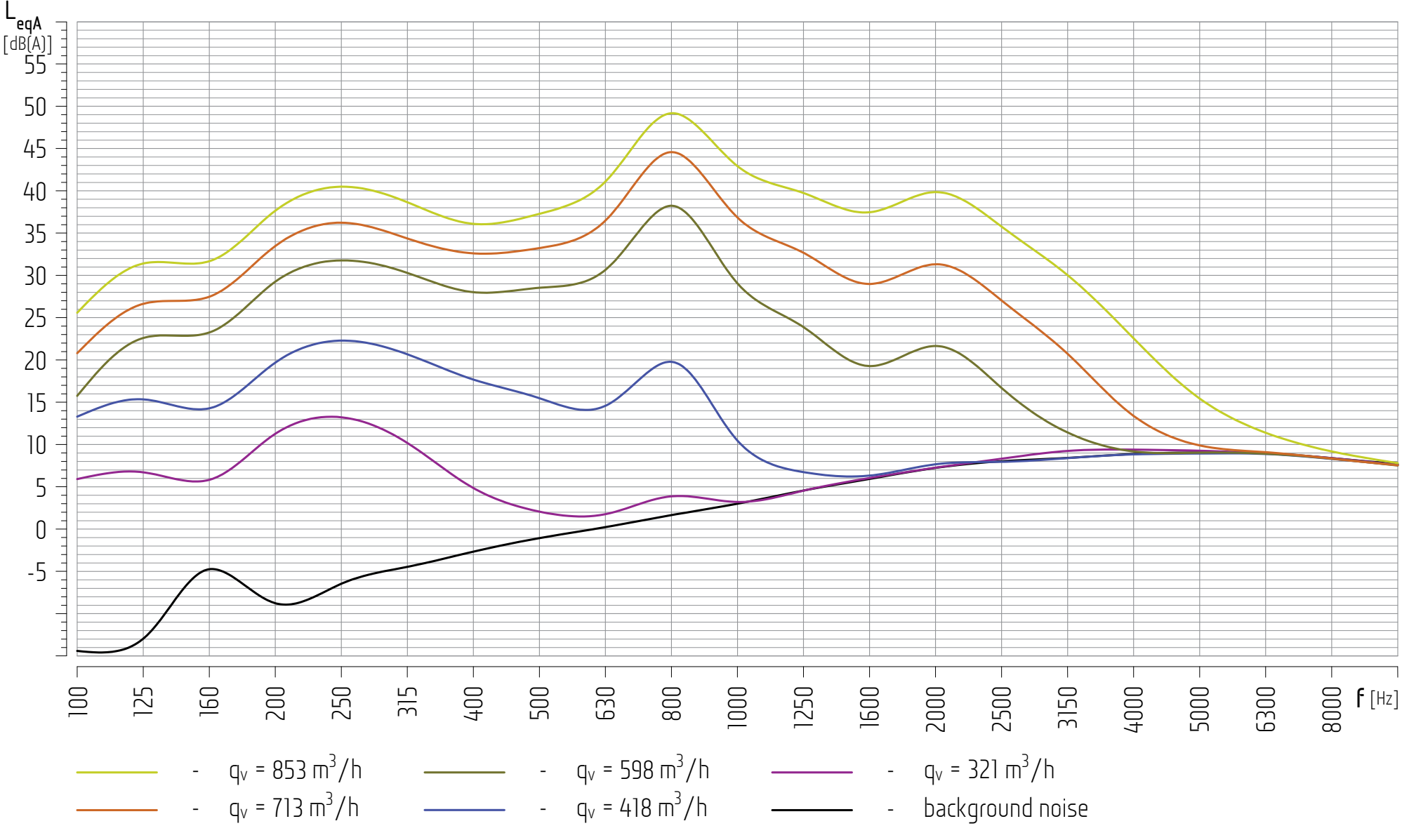
Figure 12 - GRAPHIC OF THE NOISE SPECTERS FOR BLANC 70 DIFFUSORS



qv - volume flow rate [m³/h]; **LeqA** - sound pressure level with correction A [dB(A)]; **f** - third-octave band with geometric mean frequency [Hz].

ACOUSTIC TEST RESULTS FOR BLANC 50-80

Figure 13 - GRAPHIC OF THE NOISE SPECTERS FOR BLANC 80 DIFFUSORS



qv - volume flow rate [m³/h]; **LeqA** - sound pressure level with correction A [dB(A)]; **f** - third-octave band with geometric mean frequency [Hz].

WEB

invisiline

невидимые
щелевые
решетки