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TEST REPORT
No. LAV 7624/23

Subject:	**INSERTION LOSS AND TRANSMISSION LOSS OF DUCTED SILENCER – GREENDEC Sanitized (glass wool blanket 25 mm)**
Client:	DEC INTERNATIONAL, Panonska 14, Stara Pazova, Republic of Serbia
Requirement / Offer / Contract:	IMS No. 41-7829 from 26th June 2023. / 41-7840 from 26th June 2023.
Contents:	Number of pages in report is 8 and in annex 2 pages
Report approval:	Laboratory for Acoustics and Vibrations Manager, Aleksandar Milenković, M.Sc.

Belgrade, September 20th 2023.

TASK

The measurement of insertion loss and transmission loss of ducted silencer **GREENDEC Sanitized (glass wool blanket 25 mm)**, with a length of 500 mm, 750 mm, 1000 mm, 1500 mm and seven diameters 82 mm, 102 mm, 127 mm, 160 mm, 203 mm, 254 mm and 315 mm in accordance with Standard ISO 7235.

TEST METHOD AND INSTRUMENTATION COMPLIANCE

Test method is given in following Standard:

> ISO 7235:2003, Acoustics – Laboratory measurement procedures for ducted silencers and air-terminal units – Insertion loss, flow noise and total pressure loss (idt. EN ISO 7235:2009, SRPS EN ISO 7235:2010).

Measurement equipment satisfies following Standards:

> EN 1260-1:2014, Electroacoustics – Octave-band and fractional-octave-band filters – Part 1: Specifications and
>
> EN 61672-1:2013, Electroacoustics – Sound level meters – Part 1: Specifications.

DATE AND LOCATION OF TEST

Tests were performed on 4th and 9th September 2023. in reverberation room (room volume: $V = 241.3\ m^3$) of Laboratory for acoustics and vibrations of IMS Institute, Viktora Igoa Str 7 in Belgrade.

MEASURING EQUIPMENT AND INSTRUMENTATION

Transmitting equipment:

White noise generator, model MINIRATOR MR-PRO (No G2P-XCJAS-F1), manufactured by NTI, power amplifier, model Plena (No ZX000639003513), manufactured by Bosch and pressure chamber with loudspeacker Evertone model CS-SW1250.

Receiving equipment:

Sound Level Meter, 1/1 and 1/3 octave band analyzer, model NA-28 (No 01260208), manufactured by Rion, Japan, with microphone UC-59 (No 00291); calibration certificate No. 323-2/3-02-208/2 from 9.3.2021.

Weather station, model TFA, SINUS Germany, No 35-1095.

MEASUREMENT CONFIGURATIONS

Insertion loss measurement (sound power level reduction along silenser)

The measurement configuration in accordance with test method for the determination of insertion loss is shown on Figure 1.

Sound pressure levels in reverberation room were measured in 6 discrete microphone positions with the silencer (test specimen) and in same 6 discrete microphone positions with the silencer replaced by a compensation channel.

Photografies of the measurement configuration are given on Figure 2.

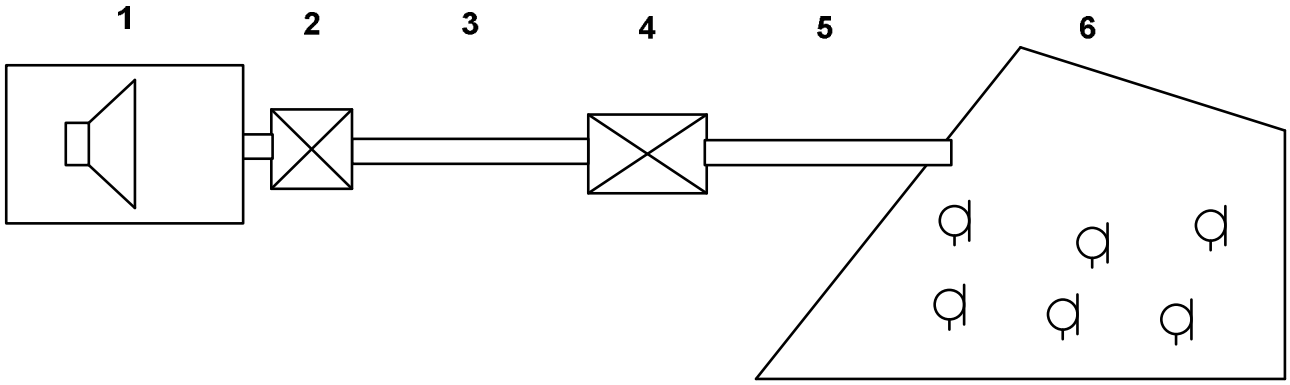

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Figure 1. Measurement configuration in accordance with ISO 7235 for insertion loss measurement;
1) Pressure chamber with loudspeacker,
2) Modal filter (silencer with circular connection Ø 400 mm with a length of 600 mm);
3) Circular duct 82 mm, 102 mm, 127 mm, 160 mm, 203 mm, 254 mm and 315 mm,
4) Silencer (specimen of test object),
5) Circular duct 82 mm, 102 mm, 127 mm, 160 mm, 203 mm, 254 mm and 315 mm,
6) Reverberation room with volume 241.3 m³.

Transmission loss measurement (sound power level reduction through the wall of silenser)

The measurement configuration in accordance with test method for the determination of transmission loss is shown on Figure 2.

Sound pressure levels in reverberation room were measured in 6 discrete microphone positions with the silencer (test specimen) and in same 6 discrete microphone positions without the silencer.

Photografies of the measurement configuration are given on Figure 4.

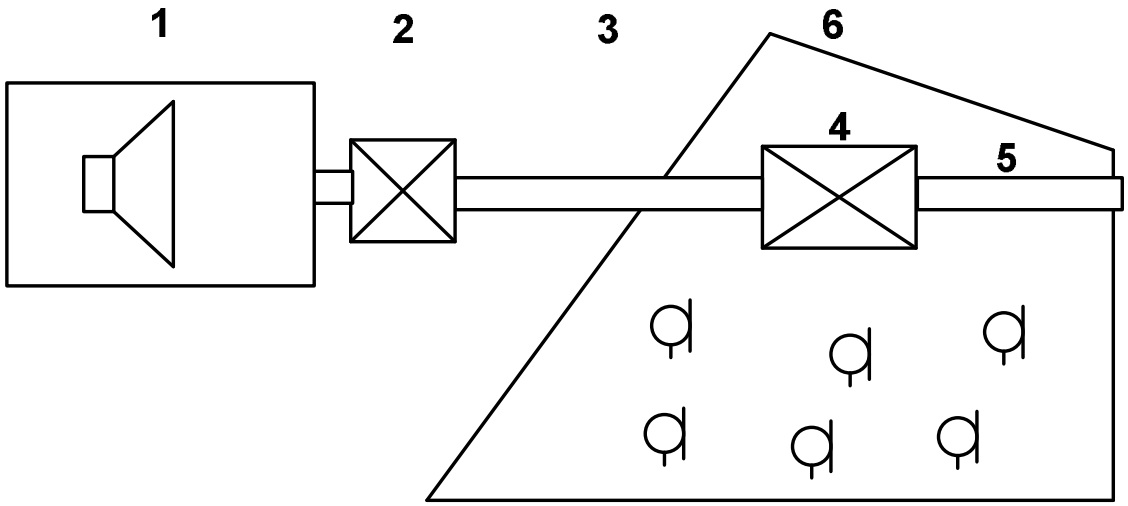
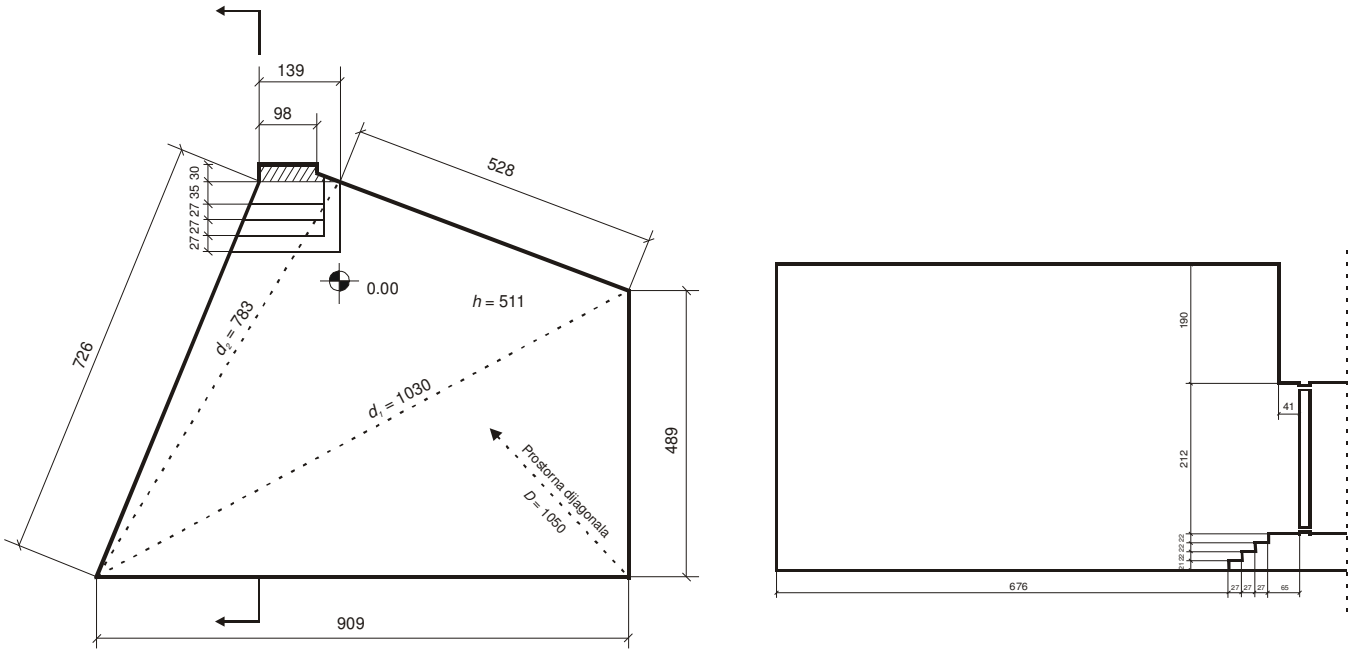


Figure 2. Measurement configuration in accordance with ISO 7235 for transmission loss measurement;
1) Pressure chamber with loudspeacker,
2) Modal filter (silencer with circular connection Ø 400 mm with a length of 600 mm);
3) Circular duct 82 mm, 102 mm, 127 mm, 160 mm, 203 mm, 254 mm and 315 mm,
4) Silencer (specimen of test object),
5) Circular duct 82 mm, 102 mm, 127 mm, 160 mm, 203 mm, 254 mm and 315 mm,
6) Reverberation room with volume 241.3 m³.

TEST FACILITY

Draft of testing room is given in Figure 3. Diffusers in the room are acoustic reflectors made by plywood of thickness d = 6 mm. Total number of acoustic reflectors is 23.



a) in basic *b) intersection*

Figure 3. Reverberation room

TESTING RESULTS

Sound pressure levels at each microphone position were measured with an integration time of 10 s in 1/1 octave bands in the frequency range from 63 Hz to 8000 Hz.

Each result of insertion loss D_i is the diffrence of a logharitmic average of measured sound pressure levels at all measurement positions with test specimen and with compensation channel at given frequency band.

Testing results of insertion loss D_i in dB are given on page 6.

Each result of transmission loss D_t is the diffrence of a logharitmic average of measured sound pressure levels at all measurement positions with and without test specimen at given frequency band increased with transmission loss of open end of test specimen D_{td}.

Testing results of transmission loss D_t in dB are given on page 7.

Estimated standard deviation of reproducibility for each frequency bands are given in ISO 7235:2003, Table 7. Measurement uncertainty U must be expressed as an expanded measurement uncertainty obtained by multiplying estimated standard deviation of reproducibility by the coverage factor k = 2, which corresponds to a confidence level of 95%.

CLIENT: **DEC INTERNATIONAL, Panonska 14, 22300 STARA PAZOVA, Republic of Serbia**

TEST SUBJECT (SPECIMEN):
GREENDEC Sanitized (glass wool blanket 25 mm)
consists of a **Polypropylene fabric cloth inner duct**, protected with the antimicrobial Sanitized hygienic function.

DATE OF TEST: 4th and 9th September 2023.

ENVIRONMENTAL CONDITIONS:
4th Septembe 2023.: t = 24°C, ψ = 55 %, 9th September 2023: t = 23°C, ψ = 61 %

Test method according to ISO 7235:2003

GREENDEC Sanitized (glass wool blanket 25 mm)									
Ø (mm)	L (mm)	Insertion loss D_i (dB)							
		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
82	500	13.2	10.3	17.7	25.2	32.1	35.0	38.4	19.4
102	500	2.9	11.0	18.6	25.6	24.3	30.1	38.1	13.5
127	500	1.6	5.3	11.3	22.6	21.4	26.2	31.3	11.5
82	750	4.9	12.6	22.8	39.7	39.2	43.9	39.6	21.1
102	750	8.6	18.6	32.3	34.0	30.3	37.3	41.7	20.6
127	750	9.4	16.7	28.5	29.4	26.7	31.7	39.9	17.5
82	1000	5.9	13.1	27.2	40.2	35.4	42.3	38.2	21.2
102	1000	3.7	17.4	28.3	39.7	32.3	40.0	41.3	22.8
127	1000	6.3	10.7	23.0	36.4	34.9	40.0	40.9	20.8
82	1500	8.9	20.8	36.6	41.6	37.3	46.4	39.6	21.3
102	1500	5.9	19.9	30.1	42.9	37.3	47.3	42.4	24.0
127	1500	12.5	14.1	27.3	42.5	37.4	42.6	42.4	25.3
160	500	0.8	4.3	10.9	17.1	17.9	19.7	21.9	14.2
203	500	5.3	11.0	15.6	13.8	12.9	15.3	13.3	5.8
254	500	4.5	7.8	11.4	11.6	11.7	11.7	5.2	3.1
315	500	4.8	11.5	11.2	9.0	8.1	5.7	2.5	1.7
160	750	1.5	8.8	19.3	22.4	20.6	25.7	32.2	14.4
203	750	4.6	15.1	19.6	18.2	18.1	24.1	19.2	8.0
254	750	2.2	10.7	14.5	16.3	16.2	19.3	10.3	4.6
315	750	3.9	13.8	14.6	13.7	13.1	10.4	4.2	1.2
160	1000	1.4	12.5	28.5	27.3	25.1	29.7	37.1	18.9
203	1000	5.6	15.3	24.9	25.7	24.4	32.3	27.7	15.2
254	1000	6.1	15.8	21.1	21.4	20.1	25.2	13.3	7.3
315	1000	8.3	20.8	18.8	16.1	16.6	16.2	7.9	4.7
160	1500	1.2	12.7	28.0	39.3	33.3	36.7	40.1	21.9
203	1500	8.5	19.1	36.1	30.0	28.5	32.5	33.2	13.9
254	1500	8.3	16.5	29.7	25.1	26.2	30.2	18.7	9.4
315	1500	10.4	28.2	24.1	20.2	22.3	20.4	9.8	10.2

GREENDEC Sanitized (glass wool blanket 25 mm)									
Ø (mm)	L (mm)	Transmission loss D_t (dB)							
		63 Hz	125 Hz	250 Hz	500 Hz	1000 Hz	2000 Hz	4000 Hz	8000 Hz
82	500	34.9	27.1	20.3	13.7	10.1	9.2	12.8	34.9
102	500	29.0	24.1	16.3	12.2	10.4	11.6	14.4	29.0
127	500	33.7	23.4	18.2	11.7	10.8	10.5	13.3	33.7
82	750	34.5	27.1	20.1	12.5	9.6	9.7	13.5	34.5
102	750	25.9	20.7	14.5	8.9	6.8	9.7	12.6	25.9
127	750	29.3	22.2	16.1	8.2	7.4	9.1	12.2	29.3
82	1000	31.5	26.2	18.3	11.5	8.4	8.0	11.5	31.5
102	1000	28.7	23.9	16.4	10.2	6.9	10.2	12.7	28.7
127	1000	30.5	24.7	18.6	10.7	9.2	10.1	12.9	30.5
82	1500	36.0	26.2	20.7	12.4	8.5	8.7	12.2	36.0
102	1500	26.4	22.9	15.3	10.3	6.7	10.1	12.2	26.4
127	1500	30.4	23.2	18.0	10.2	9.5	10.6	13.2	30.4
160	500	26.2	21.4	17.0	11.2	9.7	9.8	11.9	26.2
203	500	26.3	19.8	10.9	5.2	5.6	8.3	10.7	26.3
254	500	29.0	19.3	11.3	8.6	8.9	10.2	14.0	29.0
315	500	22.4	16.0	9.4	7.0	7.1	7.9	12.8	22.4
160	750	24.5	21.5	16.3	10.8	9.7	9.9	11.8	24.5
203	750	26.3	19.8	11.5	6.3	6.6	8.7	11.7	26.3
254	750	28.4	20.2	11.1	8.5	9.1	10.1	13.3	28.4
315	750	23.5	15.9	9.9	7.5	7.6	8.3	12.5	23.5
160	1000	23.2	22.0	17.5	11.5	10.5	10.5	11.9	23.2
203	1000	26.5	20.3	12.5	7.6	7.7	10.4	12.0	26.5
254	1000	26.4	19.9	10.7	8.2	8.2	9.4	11.8	26.4
315	1000	20.3	15.2	8.7	6.7	7.3	7.9	12.2	20.3
160	1500	20.2	22.6	18.9	12.3	11.3	11.1	12.6	20.2
203	1500	24.1	21.2	12.8	7.3	7.6	10.6	12.6	24.1
254	1500	28.1	21.2	13.4	9.7	9.8	11.0	12.8	28.1
315	1500	19.8	16.5	10.0	7.9	8.0	8.3	11.9	19.8

EXECUTANT OF TESTING: Stevka Baralić, eng.

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CONCLUSION

It was performed the measurement of insertion loss and transmission loss of ducted silencer **GREENDEC Sanitized (glass wool blanket 25 mm)**, with a length of 500 mm, 750 mm, 1000 mm, 1500 mm and seven diameters 82 mm, 102 mm, 127 mm, 160 mm, 203 mm, 254 mm and 315 mm and in accordance with Standard ISO 7235 in accordance with Standard ISO 7235.

Technical description of test object made by Client is given in the annex of the Test Report.

Testing results of insertion loss D_i are given on page 6 and of transmission loss D_t are given on page 7 in all 1/1 octave bands in the range from 63 Hz to 8000 Hz.

Test manager

Aleksandar Milenković, M.Sc.

ANNEX

- Product Technical Specification of test object made by Client (2 pages)

- The End of Test Report -