SCANVIBRA

Ship noise & vibration consultancy

TECHNICAL REPORT

Acoustic properties of deck coverings

PU-D20 steel

Prepared by: Ulrik M. Rasmussen

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1. Introduction

An investigation has been performed to determine the acoustic properties of the noise reducing deck covering type PU-D20 steel system.

2. Definitions

Impact sound

The noise from impacts such as steps, walking etc overhead the receiving room is described by the normalized impact sound pressure level as follows:

$$L_n = L_i + 10 \log (A/10m^2) \text{ (dB)}$$

L_i: sound pressure re 10^{-9} Pa (dB)
A: receiving room equivalent absorption area (m^2)

Based on the L_n values and their frequency dependence, the single value weighted normalized impact sound pressure L_{nw} is determined based on the procedure in ISO 717/2.

Structureborne sound

The structureborne noise radiated from the deck into the receiving room above is described by the sound power as follows:

$$L_w = L_v + 10\log\sigma + 10\log(S/1m^2) - 34 \text{ (dB)}$$

L_v:	vibration velocity re 10^{-9} m/s (dB)
$10\log\sigma$:	radiation index (dB)
S:	area of deck (m^2)

The notation (*) is introduced for the bare steel reference deck. The notations (above/below) are introduced for top and bottom of the deck covering (relevant for floating floors).

Thus, the structureborne noise related acoustic properties are as follows:

$$IL_v = L_{v,above} - L_v^* \text{ (dB)}$$

$$10\log\sigma = L_w - L_{v,above} - 10\log(S/1m^2) + 34 \text{ (dB)}$$

IL_v:	insertion loss velocity (dB)
$10\log\sigma$:	radiation index (dB), deck including covering
$L_{v,above}$:	vibration velocity re 10^{-9} m/s (dB), deck including covering, top of deck covering
L_v^*:	vibration velocity re 10^{-9} m/s (dB), bare steel reference deck
S:	area of deck (m^2)

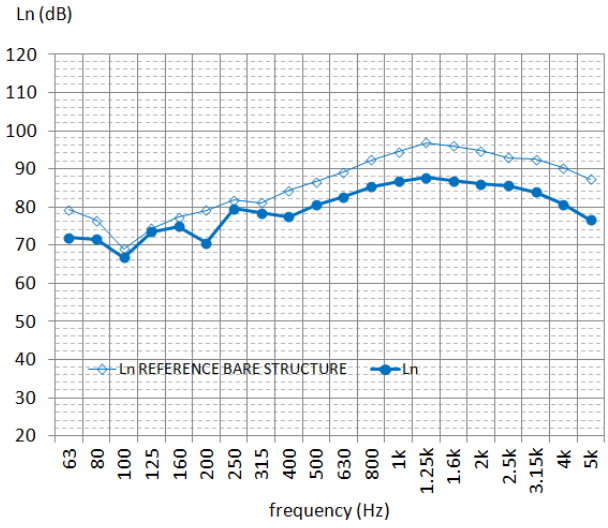
3. Results

The relevant results and data are shown in the attached diagrams. The acoustic properties refer to impact noise from steps or similar overhead the receiving rooms, and structureborne noise radiated from the deck into the receiving rooms above the deck.

A. Deck covering: PU-D20 steel

Reference deck: 6 mm steel, stiffened panel.

B. Acoustic properties I



Hz	dB
63	72.0
80	71.6
100	66.8
125	73.5
160	74.9
200	70.6
250	79.6
315	78.4
400	77.4
500	80.5
630	82.7
800	85.4
1000	86.7
1250	87.7
1600	86.9
2000	86.0
2500	85.6
3150	83.9
4000	80.7
5000	76.6

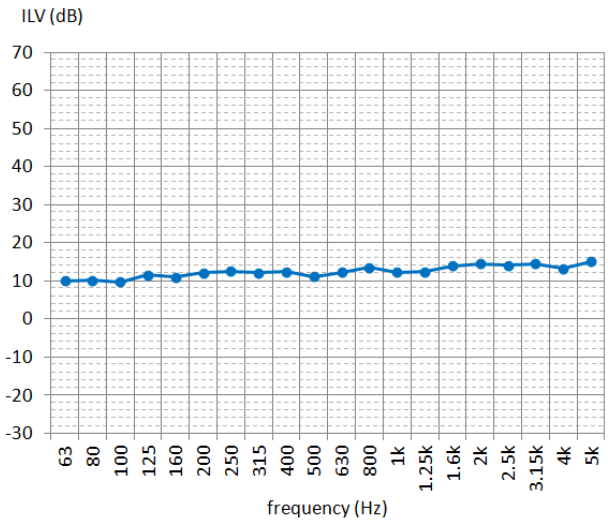
Normalized impact sound pressure level Ln

dB re 20 microPa
per 1/3-octave frequency band.

Ln is measured below the test deck and serves to evaluate reduction of noise from activity overhead e.g. walking.

The weighted normalized value Lnw provides an overall single number for the frequency range 100 Hz to 3.15 kHz.

Lnw: 92 dB



Hz	dB
63	10.1
80	10.2
100	9.8
125	11.6
160	11.0
200	12.1
250	12.6
315	12.2
400	12.4
500	11.1
630	12.3
800	13.6
1000	12.2
1250	12.5
1600	14.0
2000	14.5
2500	14.2
3150	14.5
4000	13.3
5000	15.1

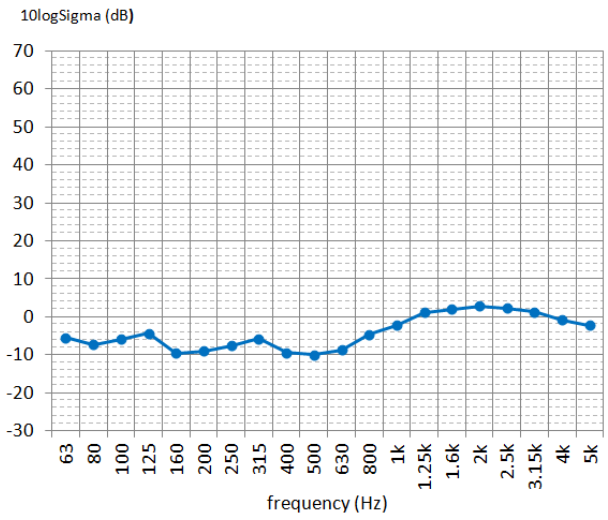
Insertion loss ILv

dB mean velocity
per 1/3-octave frequency band.

The insertion loss refers to the top of the deck covering.

ILv serves to evaluate the reduction of the structureborne velocity level in the floor.

C. Acoustic properties II



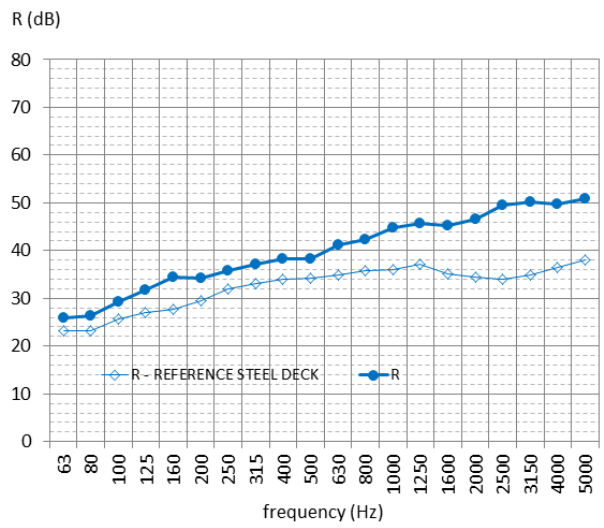
Hz	dB
63	-5.4
80	-7.4
100	-5.8
125	-4.4
160	-9.5
200	-9.0
250	-7.6
315	-5.8
400	-9.4
500	-10.0
630	-8.7
800	-4.6
1000	-2.2
1250	1.2
1600	2.0
2000	2.9
2500	2.3
3150	1.4
4000	-0.9
5000	-2.2

Radiation index 10logSigma

dB
per 1/3-octave frequency band.

10log Sigma describes the radiated sound for given vibration velocity in the floor.

No 2: PU-D20 steel



Hz	dB
63	26.0
80	26.4
100	29.3
125	31.7
160	34.5
200	34.3
250	35.7
315	37.2
400	38.3
500	38.2
630	41.2
800	42.3
1000	44.8
1250	45.6
1600	45.2
2000	46.5
2500	49.5
3150	50.3
4000	49.7
5000	50.9

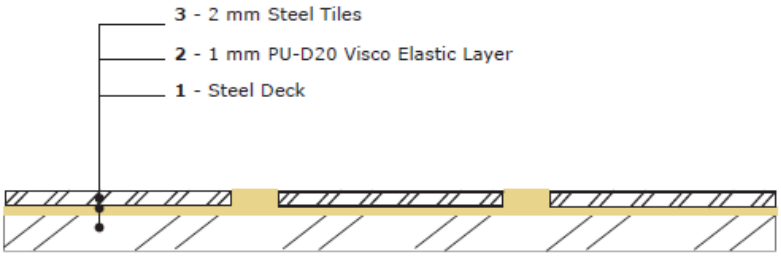
Airborne sound insulation
Sound insulation index (R)

dB
per 1/3-octave frequency band.

R is a measure for the sound insulation of the deck and is used for assessment of the noise reduction between rooms on top of each other.

The weighted normalized value Rw provides an overall single number for the frequency range 100 Hz to 3.15 kHz.

Rw: 44 dB



$R = L_1 - L_2 + 10 \log (S/A)$ (dB)

L_1: sound pressure in source room (dB)
L_2: sound pressure in receiving room (dB)
S: area of dividing partition between the rooms / test specimen (m^2)
A: receiving room equivalent absorption area (m^2)

Reference deck: 6 mm steel, stiffened panel.