CENTRUM STAVEBNÍHO INŽENÝRSTVÍ a. s.
CENTRE OF BUILDING CONSTRUCTION ENGINEERING plc.
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Testing laboratory of physical properties of materials, structures and buildings – Zlín, Testing laboratory No. 1007.1, accredited by the CAI

L 1007.1

Test Report No. 136/15

Laboratory Measurement of Airborne and of Impact Sound Insulation according to ČSN EN ISO 10140-2, ČSN EN ISO 10140-3

Test subject: Wooden ceiling panels with filling, with oak parquet floor, with limestone subbase filling, with tiles, with Isover, Steico and Starlon insulation

Contract No: 563 339

Number of pages: 8
Number of copies: 2
Copy No.: 1e

Customer: **AGROP NOVA a.s.**
Ptenský Dvorek 99
798 43 Ptení
Czech Republic

Sample accepted on: 01.04.2015
Tested on: 02.04.2015
Tested by the Building Acoustics Laboratory
Technical head of laboratory: Ing. Miroslav Figalla
Head of testing laboratory No. 1007.1:
Ing. Miroslav Figalla . . . . . .

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Date: 10.04.2015

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1. Assignment

The test was carried out based on the order, contract No. 563 339.

2. Subject of Test

To perform laboratory measurement of airborne sound insulation and impact sound insulation in accordance with standards ČSN EN ISO 10140-2, ČSN EN ISO 10140-3.

Element tested: Wooden ceiling panels with filling, with oak parquet floor, with limestone subbase filling, with tiles, with Isover, Steico and Starlon insulation. NOVATOP ELEMENT panels are large ribbed components made of multi-layer solid panels. The structure of the element is composed of a bearing bottom multi-layer panel, whose thickness depends on the required fire resistance of the construction. Transverse and longitudinal ribs, whose height depends on the bearing capacity of the element, are glued to it. The whole structure is enclosed with a top multi-layer panel. Cavities are infilled with limestone grit. Drawings of ceiling are shown on pages 7 and 8.

3. Test Sample

The Customer provided material for the ceiling construction on 01.04.2015. The ceiling of dimensions 3600 mm x 3000 mm has been assembled from two elements, in the test hole for horizontal constructions. Lateral seams along the ceiling circumference have been sealed with textile cord and rubber profile. Assembly of the floor has been performed together by the Customer and laboratory staff.

4. Standards used and measuring equipment

4.1 Standards

- ČSN EN ISO 10140-1 Acoustics. Laboratory measurement of sound insulation of building elements. Part 1: Application rules for specific products,
- ČSN EN ISO 10140-2 Acoustics. Laboratory measurement of sound insulation of building elements. Part 2: Measurement of airborne sound insulation,
- ČSN EN ISO 10140-3 Acoustics. Laboratory measurement of sound insulation of building elements. Part 3: Measurement of impact sound insulation,
- ČSN EN ISO 10140-4 Acoustics. Laboratory measurement of sound insulation of building elements. Part 4: Measurement procedures and requirements,
- ČSN EN ISO 717-1 Acoustics. Rating of sound insulation in buildings and of building elements. Airborne sound insulation.
- ČSN EN ISO 717-2 Acoustics. Rating of sound insulation in buildings and of building elements. Part 2: Impact sound insulation.

Related standards:

- ČSN EN ISO 10140-5 Acoustics. Laboratory measurement of sound insulation of building elements. Part 5: Requirements for test facilities and equipment,
- ČSN EN 20140-2 Acoustics – Measurement of sound insulation in buildings and of building elements. Part 2: Determination, verification and application of precision data.

4.2 Measuring equipment

- Norsonic RTA 840 analyzer	M 07 2024
- B. K. measuring microphone	M 07 2005
- acoustic calibrator B.K.	M 07 2015
- tapping machine B.K.	I 10 780
- power amplifier AM-39	I 05160
- omnidirectional sound source	I 52346

5. Testing Procedure

5.1 Airborne sound insulation

Measuring is performed in sound chambers meeting the requirements of the ČSN ISO 10140-5 standard. The tested element is mounted between the source and receiving room into a measuring opening for horizontal elements. A steady sound is generated in the source room with continuous spectrum in the 100 to 5000 Hz band. Mean sound levels of acoustic pressure are measured in the source and receiving room (in dB). Sound reduction index is determined by the relations

$$R = L_1 - L_2 + 10 \log \frac{S}{A} \quad \text{(dB)}, \qquad A = \frac{0{,}16\,V}{T} \quad (\text{m}^2)$$

where L_1 is the average sound pressure level in the source room,
L_2 .. average sound pressure level in the receiving room,
S ... area of the test sample in m^2,
A ... equivalent absorption area in the receiving room in m^2,
V … is the volume of the receiving room in m^3,
T ... reverberation time in the receiving room in seconds

A single-number quantity, weighted sound reduction index R_w, and spectrum adaptation terms C, C_{tr}, are determined from the values of sound reduction index R in third-octave bands 100 to 3150 Hz, using the reference curve and method according to ČSN EN ISO 717-1.

5.2 Impact Sound Insulation

A normalised impact source is placed on the measured floor. Mean levels of acoustic pressure in the receiving room (lower room) in individual third octave bands in the range of 100 (50) to 5000 Hz are measured. A normalized impact sound level L_n is calculated using the following equation

$$L_n = L_i + 10 \log \frac{A}{A_0} \qquad \text{(dB)},$$

where L_i is a mean level of acoustic pressure in the receiving room,
A ... equivalent absorption area in the receiving room in m^2,
A_0 .. reference value, $A_0 = 10\ m^2$.

A single-number quantity, weighted normalized impact sound level $L_{n,w}$, and spectrum adaptation term C_I, are determined from the values of normalized impact sound level L_n in third-octave bands 100 to 3150 Hz, using the reference curve and method according to ČSN EN ISO 717-2.

6. Test Results

Reg. No.	Description of the ceiling	Airborne Sound Insulation Impact Sound Insulation
86/15 85/15	Wooden ceiling panels with filling, with oak parquet floor, with limestone subbase filling, with tiles, with Isover, Steico and Starlon insulation	R_w (C; C_{tr}) = 63 (-2; -5) dB $L_{n,w}$ (C_I) = 45 (1) dB

The courses of sound reduction index and normalized impact sound pressure level depend on the frequency and further measurement data are shown in standard measuring records on pages 5 - 6.

7. Measurement Uncertainty

Measurement uncertainty is to be expressed in accordance with ČSN EN 20140-2 using the indices of repeatability *r* and reproducibility *R* that are the values under which the absolute value of the difference of the results of tests performed under specified conditions will lie with the probability of 95 %. For a single-number quantities R_w, L_{nw}, the repeatability index *r* = 1 dB, the reproducibility index *R* = 2 dB.

In charge for the test: Ing. Miroslav Figalla

Note:

This document is a translation of the Test Report No. 136/15 dated 10.04.2015. In case of ambiguity or doubts, the Czech version prevails.

Sound reduction index in accordance to EN ISO 10140-2

Laboratory measurement of airborne sound insulation of building elements

Reg. No.: 86/15

Customer:
AGROP NOVA a.s.
Ptenský Dvorek 99
798 43 Ptení
Czech Republic

Product: Wooden ceiling with floor

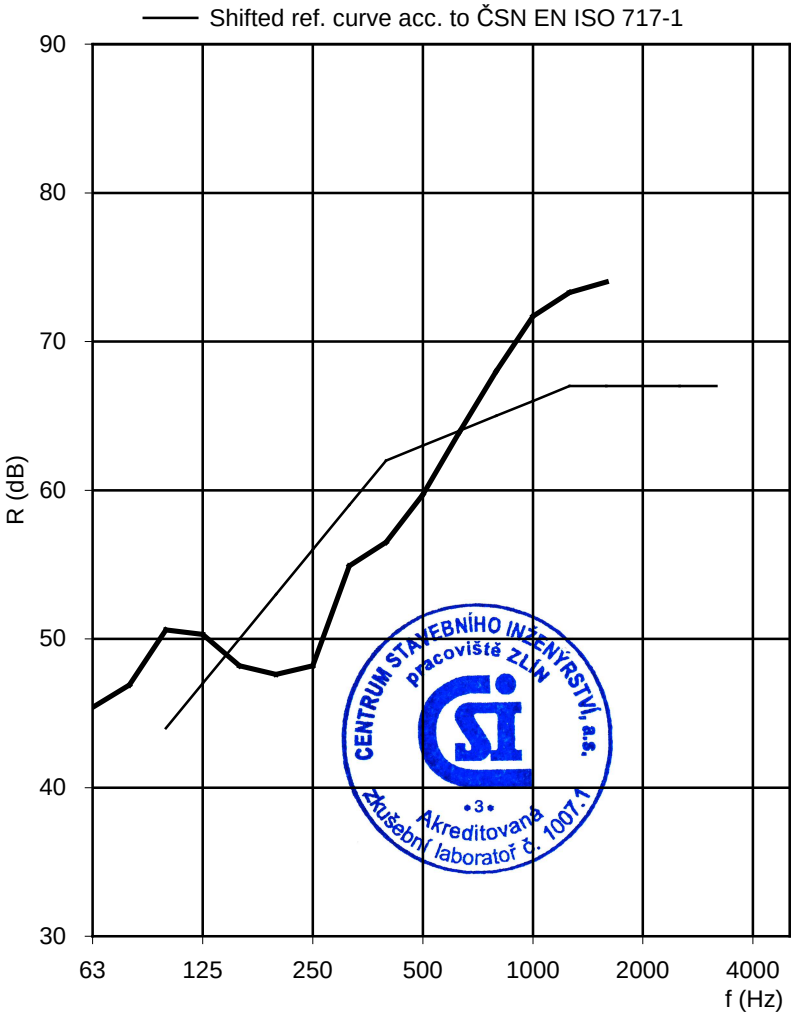
Composition of the structure:
- floor: oak parquet floor, thickness of 12 mm, 7 kg/m^2, Steico Underfloor thickness of 5 mm, 1 kg/m^2, concrete screed thickness of 50 mm, 120 kg/m^2, Isover TDPT thickness of 20 mm, 2.3 kg/m^2, limestone subbase filling thickness of 30 mm, 52 kg/m^2, Starlon thickness of 6 mm (XPS), 0.2 kg/m^2,
- ceiling: top panel NOVATOP ELEMENTS thickness of 27 mm, transversal and longitudinal ribs 180 mm + limestone grit 80 kg/m^2, bottom panel NOVATOP ELEMENTS thickness of 33 mm.

Dimensions of the ceiling: 3600 mm x 3000 mm, thickness 363 mm, surface weight 304 kg/m^2.

Conditions of the test			
Area of test element:	10 m^2	Test date:	02.04.2015
Source room volume:	90 m^3	Air temperature:	18 °C
Receiving room volume:	75 m^3	Relative humidity:	45 %
		Static pressure:	980 hPa

Freq. (Hz)	*R* 1/3 okt. (dB)
50	29,2
63	45,4
80	46,9
100	50,6
125	50,3
160	48,2
200	47,6
250	48,2
315	54,9
400	56,5
500	59,7
630	63,9
800	68,0
1000	71,7
1250	73,3
1600	74,0
2000	>73,5
2500	>71,3
3150	>70,3
4000	>69,1
5000	>66,9
Rating according EN ISO 717-1	
R_w (C; C_{tr}) = 63 (-2; -5) dB	

$C_{50\text{-}3150}$ = -2 dB, $C_{tr,50\text{-}3150}$ = -11 dB
$C_{50\text{-}5000}$ = -1 dB, $C_{tr,50\text{-}5000}$ = -11 dB
$C_{100\text{-}5000}$ = -1 dB, $C_{tr,100\text{-}5000}$ = -5 dB



Centrum stavebního inženýrství a.s.
pracoviště Zlín

Date: 10.04.2015

Ing. Miroslav Figalla
Head of laboratory

Normalized impact sound pressure level in accordance with ISO 10140-3 Laboratory measurements of impact sound insulation of floors	Reg. No.: 85/15

Customer:
AGROP NOVA a.s.
Ptenský Dvorek 99
798 43 Ptení
Czech Republic

Product: Wooden ceiling with floor

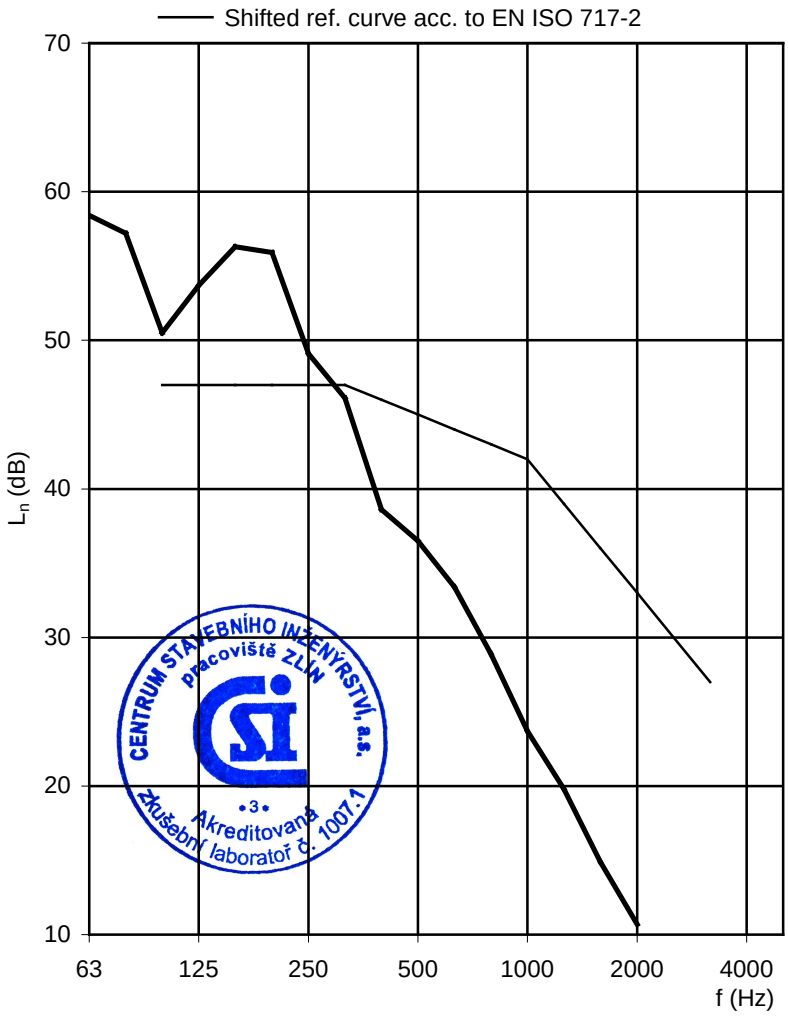
Composition of the structure:
- floor: oak parquet floor, thickness of 12 mm, 7 kg/m^2, Steico Underfloor thickness of 5 mm, 1 kg/m^2, concrete screed thickness of 50 mm, 120 kg/m^2, Isover TDPT thickness of 20 mm, 2.3 kg/m^2, limestone subbase filling thickness of 30 mm, 52 kg/m^2, Starlon thickness of 6 mm (XPS), 0.2 kg/m^2,
- ceiling: top panel NOVATOP ELEMENTS thickness of 27 mm, transversal and longitudinal ribs 180 mm + limestone grit 80 kg/m^2, bottom panel NOVATOP ELEMENTS thickness of 33 mm.

Dimensions of the ceiling: 3600 mm x 3000 mm, thickness 363 mm, surface weight 304 kg/m^2.

Conditions of the test			
Area of test element:	10 m^2	Test date:	02.04.2015
Source room volume:	90 m^3	Air temperature:	18 °C
Receiving room volume:	75 m^3	Relative humidity:	45 %
		Static pressure:	980 hPa

Freq. (Hz)	L_n 1/3 okt. (dB)
50	65,6
63	58,4
80	57,2
100	50,5
125	53,7
160	56,3
200	55,9
250	49,1
315	46,1
400	38,6
500	36,5
630	33,4
800	28,9
1000	23,7
1250	19,8
1600	14,9
2000	10,7
2500	<10,3
3150	<12,0
4000	<13,1
5000	<11,3
Rating according EN ISO 717-2	
$L_{n,w}$ (C_I) = 45 (1) dB	

$C_{I,50\text{-}2500}$ = 8 dB

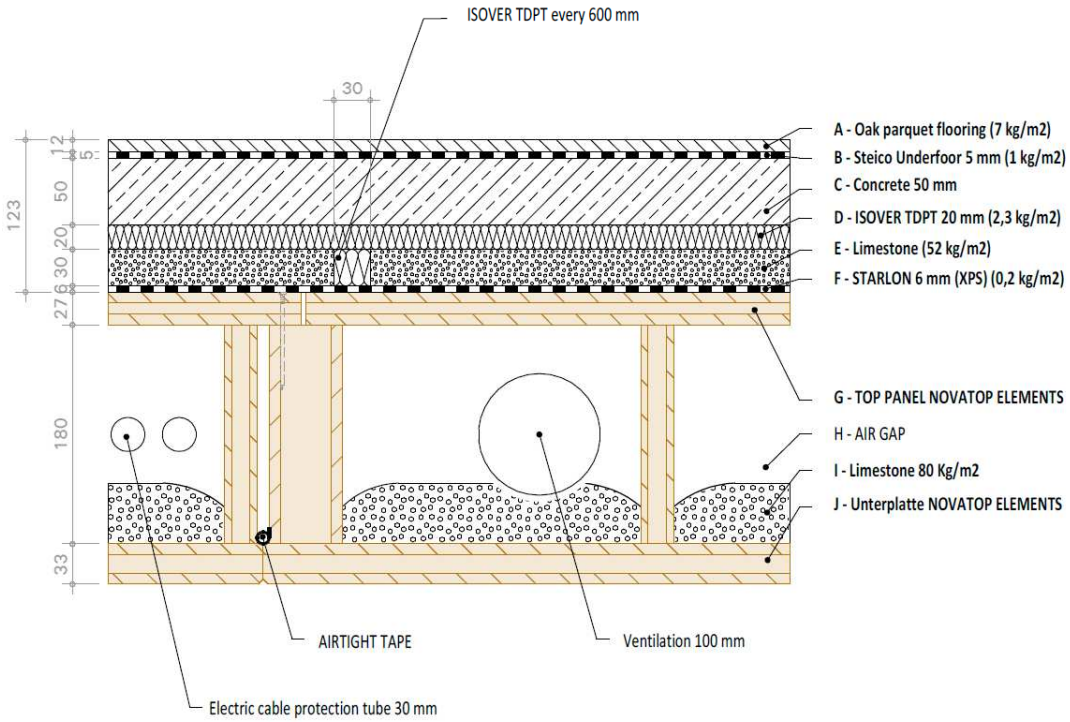


Centrum stavebního inženýrství a.s.
pracoviště Zlín

Date: 10.04.2015

Ing. Miroslav Figalla
Head of laboratory

Composition of the Floor III.

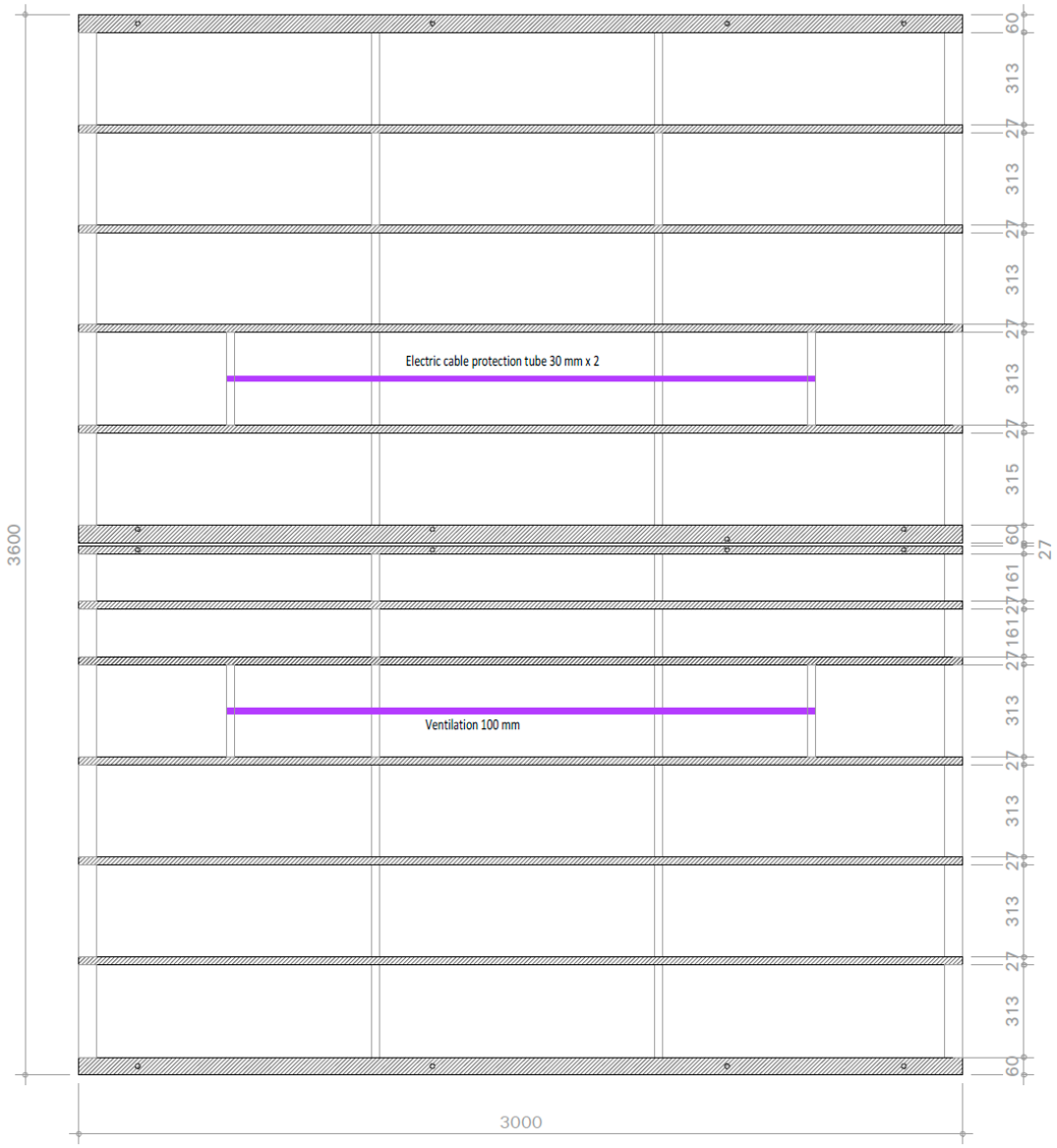


NOVATOP AGROP

Vojtěch Jemelík
Composition of the Floor III.

Řez A-A
Řez B-B

AGROP NOVA a.s.
Ptenský Dvorek 99
798 43 Ptení
Česká republika



NOVATOP AGROP

Vojtěch Jemelík

Geschossdecke

Řez A-A

Řez B-B

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