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TEST REPORT

Sound Insulation Testing of the recessed downlights according to BS EN ISO 10140-2 and BS EN ISO 10140-3 for Part E of the Building Regulations

Prepared for: SG Armaturen AS
Date: 02.12.2024
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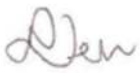
Signature	

Authorised by:

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Date	29 November 2024
Signature	

Executive Summary

- SG Armaturen AS commissioned the Building Research Establishment (BRE) to measure the airborne and impact sound insulation performance of SG Armaturen AS downlight when installed in Robust Details Limited Appendix F floor.

- The tests were conducted in accordance with BS EN ISO 10140-2:2021 and BS EN ISO 10140-3:2021. Single number quantities were calculated in accordance with BS EN ISO 717-1:2020 and BS EN ISO 717-2:2020. BRE is a UKAS accredited testing laboratory for testing in accordance with BS EN ISO 10140-2:2021 and BS EN ISO 10140-3:2021.

- The SG Armaturen AS downlight tested satisfies the Robust Details Appendix F acoustic performance requirements for use with Approved Document E to The Building Regulations 2010.

Contents

1. Introduction

BRE Acoustics was commissioned by SG Armaturen AS to carry out airborne and impact sound insulation measurements in the BRE Vertical Transmission Suite (Hall D, Building 14, BRE, Garston, Watford, Hertfordshire, WD25 9XX).

This report details the testing outlined in BRE proposal P129340.

2. Testing Details

2.1 Test dates and personnel

The measurements detailed in this report were completed by Nicholas Dewhurst and Mark Coleman of BRE Acoustics on the 2nd August & 20th November 2024.

2.2 Test methods and applicable standards

Measurement of airborne and impact sound insulation was made in accordance with BS EN ISO 10140-2:2021 and BS EN ISO 10140-3:2021.

Airborne noise level measurements were undertaken in the source and receive rooms simultaneously, noise levels are created at pre-determined and qualified speaker positions using pink noise in the source room and the resultant noise level measured in the receive room below.

Impact noise is created by using a tapping machine at four locations on the upper source room floor surface and the resultant noise level is measured in the receive room below for each tapping machine position.

The background noise and reverberation times are measured and checked to be within limits.

Single number quantities were calculated in accordance with BS EN ISO 717-1:2020 and BS EN ISO 717-2:2020.

BRE Acoustics holds UKAS accreditation for the measurement of sound insulation in the laboratory.

The measurements were conducted using the procedures accredited by UKAS.

2.3 Room conditions and further information

Table 1 – Test room conditions (data provided on graphs)

Test room	Temperature (ºC)	Relative humidity (%)	Barometric pressure (kPA)
Upper Source	22 & 9	50 & 61	101.9 & 100.2
Receive	22 & 9	50 & 61	101.9 & 100.2

Sound Insulation Test Results (1/3rd octave band Information)

The sound insulation single figure test results were calculated using the 1/3rd octave data between 100 Hz and 3.15 kHz, all other 1/3rd octave data provided in the test result graph at the end of this report (namely 50 Hz, 63 Hz, 80 Hz, 4kHz & 5 kHz) are optional and provided for information purposes only, they must not be used to determine sound insulation performance at these frequencies.

Flanking Limits

The following values for flanking limits (R_{max}) were obtained using lightweight floor construction.

Lightweight floor construction with raised floor and ceiling on resilient bars **64 dB R_w**

Figure 1: R_{max} 1/3rd octave data for the lightweight floor construction and ceiling on resilient bars

Frequency *f* [Hz]	*R* 1/3 octave [dB]
50	16.4
63	35.5
80	39.8
100	37.9
125	47.5
160	49.7
200	52.5
250	53.7
315	56.3
400	59.5
500	62.1
630	63.4
800	66.1
1000	67.5
1250	69.1
1600	71.2
2000	72.0
2500	74.2
3150	77.3
4000	76.9
5000	75.0

Test Rooms Shape and Construction

The Upper Source Room is a cuboid shape approx. 100 m^3 and the perimeter walls are constructed of 102 mm thick panel (Noise-Lock 2) made up with 1.6 mm plain galvanised face sheet and a 1.2 mm galvanised back sheet with an infill that consists of two layers of 12.5 mm Gyproc board with the remaining void filled with sound absorbing material.

The Receive Room is a cuboid shape approx. 70 m^3 and is a room in a room cavity wall construction. The outer wall leaf is made up of 100 mm blockwork with a 100 mm void to the inner wall mounted on the inner floating floor. Inner wall consists of Gyproc board and absorbent material.

2.4 Test element installation

The Robust Details Appendix F floor and SG Armaturen AS downlights were installed by BRE.

2.5 Instrumentation

The equipment used to conduct the tests is identified in Table 2, below.

Table 2 - Equipment list

Instrument number	Equipment description	Manufacturer	Type	Serial number	Calibrate date
3110	Microphone Calibrator	B&K	4231	2175848	11/2024
3150/3151	Microphone	GRAS	40AE	37071/117036	11/2024
5167/5168	Microphone Preamplifier	GRAS	26CA	13085/13142	11/2024
5165/5166	Real Time Analyser	NOR	850	8501142	11/2024
3202	Tapping Machine	NOR	211	12927	12/2025
6206/6207	Loudspeaker (Source)	B&K	4292	020005/014005	N/A
3214/3216	Loudspeaker (Receive)	NOR	270H	26257/26258	N/A
3226	Rotating Boom (Source)	NOR	212NA	10418	N/A
5169	Rotating Boom (Receive)	NOR	265	29412	N/A
6866	Hygrometer	Rotronic	BL-1D	A23010113	09/2025

The gain of the real time analyser was adjusted to give a reading 113.9 dB at 1 kHz using the B&K Type 4231 calibrator.

All equipment is calibrated in accordance with BRE procedures, using reference equipment calibrated by a UKAS accredited laboratory.

2.6 Test Numbers

Table 3 lists each test element along with its corresponding test number. The construction details for each test element can be found from Table 4 by referring to the test number.

Table 3 - Test numbers

Test number	Test element	Upper Source room volume (m^3)	Receive room volume (m^3)	Common area (m^2)
L224-001	Floor	100.0	71.0	17.9
L224-002		100.0	71.0	17.9
L224-021	Downlight	100.0	71.0	17.9
L224-022		100.0	71.0	17.9

2.7 Construction details with test numbers

The construction details are shown in Table 4, below. When construction details are provided by a third party, they are checked by BRE where possible.

Table 4 – Construction & test specimen details with test numbers

Test Element	Test Number	Construction Details
Floor	L224-001	Robust Details Limited Appendix F floor: 18 mm OSB (10.9 kg/m^2) fixed to 235 mm x 50 mm joists (3.6 kg/m^2), 100 mm Isover APR 1200 (10 kg/m^3) between joists, 2 x 15 mm Fire rated plasterboard (23.4 kg/m^2) fixed to underside of joists, joints and perimeter sealed.
	L224-002	
Downlight	L224-021	SG Junistar Eco – HVIT 2700K - without airtight gasket (83 mm cutout)
	L224-022	

3. Sound insulation test results

The single number quantities for the sound insulation tests are shown in the Tables, below. The UKAS test result sheets are included in the appendices.

Robust Details Appendix F, F.3 (October 2014 update) states:

For the purposes of evaluating the influence on performance due to downlights for Robust Detail timber separating floors, four different measurements are required (2 airborne and 2 impact measurements). The following measurements are required:

Airborne

Test 1 Determination of R_w+C_{tr} for the initial timber floor

Test 2 Determination of R_w+C_{tr} for the initial timber floor plus downlights

Impact

Test 3 Determination of $L_{n,w}$ for the initial timber floor

Test 4 Determination of $L_{n,w}$ for the initial timber floor plus downlights

Table 5 below, contain values of the difference between Test 2 and Test 1 (Test 2 - Test 1) for airborne sound insulation performance and the difference between Test 3 and Test 4 (Test 3 - Test 4) for impact sound transmission performance.

Table 5 - Test results – SG Junistar Eco – HVIT 2700K – without airtight gasket (83 mm cutout)

Test number	R_w+C_{tr} (dB)	$L_{n,w}$ (dB)	Test 2 - Test 1 (dB)	Test 3 - Test 4 (dB)
1 – L224-001	34	-	0	-
2 – L224-021	34	-		
3 – L224-002	-	76	-	0
4 – L224-022	-	76		

Robust Details Appendix F, F.4 (October 2014 update) states:

For airborne sound insulation performance, the difference between Test 2 and Test 1 (Test 2 -Test 1) should be no worse than (-1dB)

For impact sound transmission performance, the difference between Test 3 and Test 4 (Test 3 -Test 4) should be no worse than (-1dB).

Based on the test results presented in Table 5, the downlights tested satisfy the Robust Details acoustic performance requirements.

4. Installation Details

The joist installation for the floor is illustrated in **Figure 3**. The ends of the joists are fixed in hangers as specified in Appendix F of Robust Details Part E. The downlight positions are shown in **Figure 4**.

Figure 3: Floor joists at 450mm centres

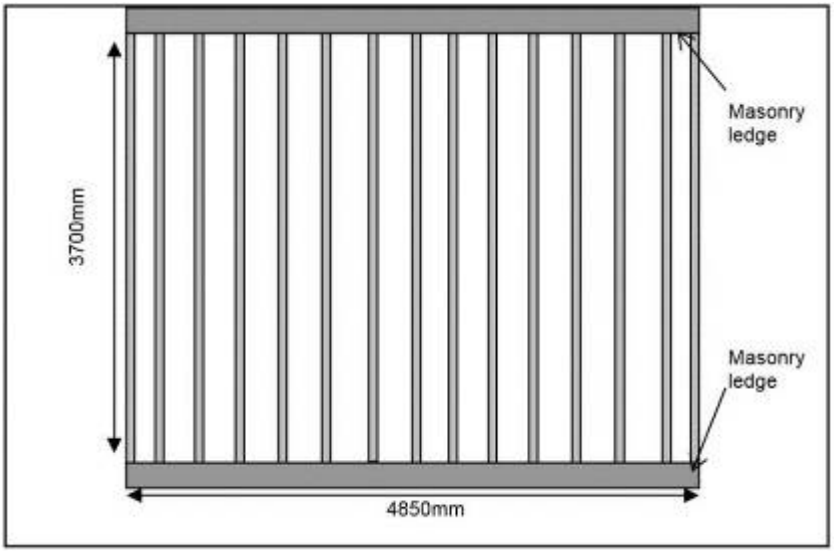
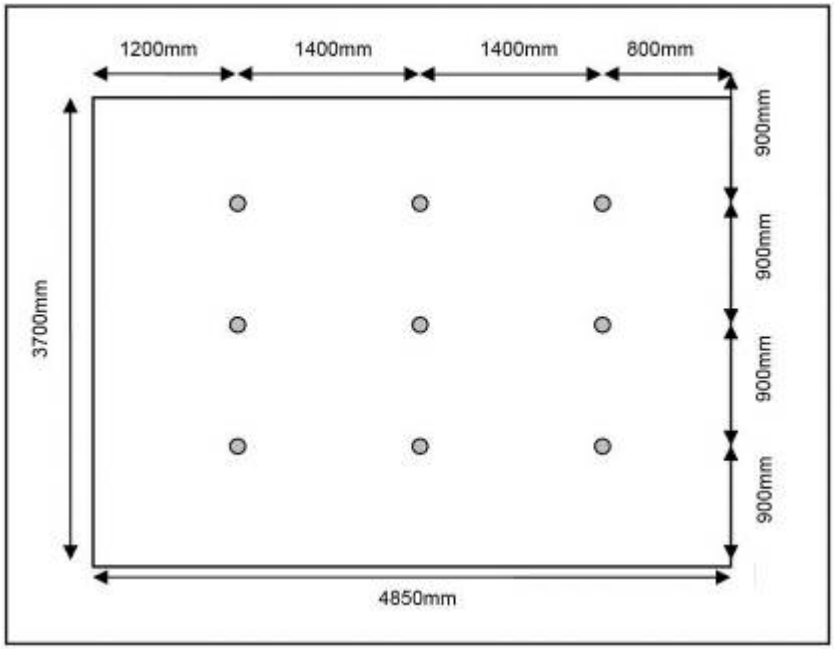


Figure 4: Positions of the downlights in the ceiling of the Robust Details Appendix F floor



5.Photographs

Figure 5: Photographs of SG Junistar Eco – HVIT 2700K – without airtight gasket

6. Appendices

6.1 Test results sheets

Page Number	Test Number
12	L224-001
13	L224-002
14	L224-021
15	L224-022

7. Amendments

7.1 Amendment table

Issue	Amendment	Date of change
1	Original	25th November 2024
2	Added “airtight” and “83 mm cutout” to light description in report and graphs. Corrected pressure in table 1 from 100.9 to 101.9	2nd December 2024

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Level difference according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

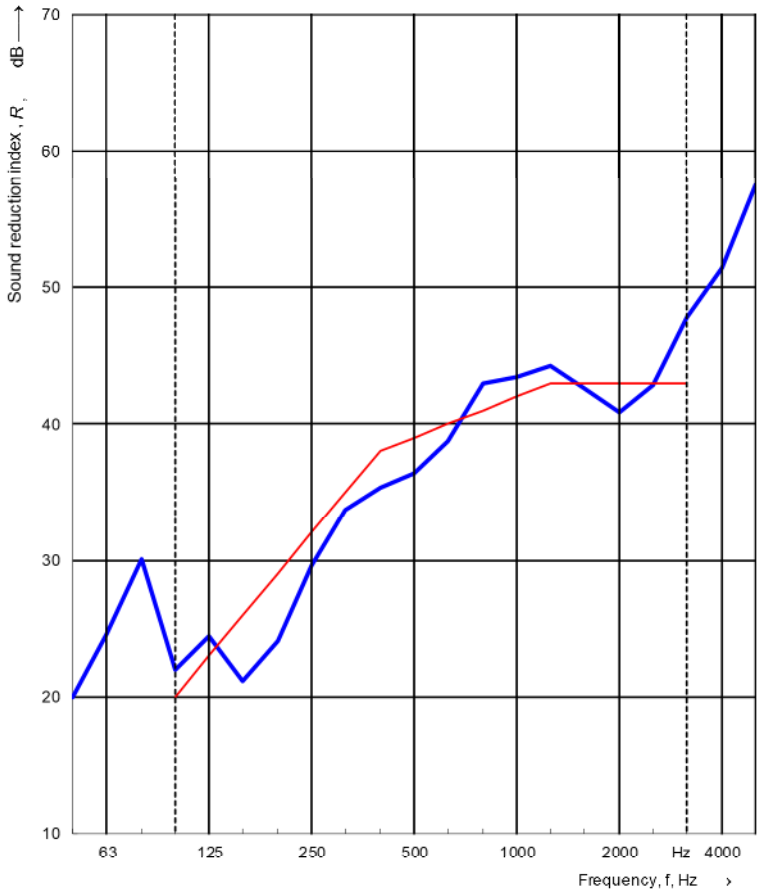
Test Laboratory: BRE Transmission Suite (Hall D)
Client: SG Armaturen AS

Date of test: 02/08/2024 **Test Number:** L224-001

Test specimen installed by: BRE
Product identification: Floor Construction
Description of the specimen: Appendix F Floor construction - Airborne

Static pressure:	101.9 kPa	**Area, S, of test element:**	17.9 m²
Air temperature:	22 °C	**Source room volume:**	112 m³
Relative air humidity:	50 %	**Receiving room volume:**	71 m³

Frequency *f* [Hz]	*R* 1/3 octave [dB]
50	20.0
63	24.5
80	30.1
100	22.0
125	24.4
160	21.2
200	24.1
250	29.6
315	33.7
400	35.4
500	36.4
630	38.7
800	43.0
1000	43.4
1250	44.3
1600	42.6
2000	40.8
2500	42.8
3150	47.8
4000	51.4
5000	57.5



Rating according to ISO 717-1

$R_w(C;C_{tr})$ = 39 (-1 ; -5) dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

$C_{50\text{-}3150}$ = -2 dB $C_{50\text{-}5000}$ = -1 dB $C_{100\text{-}5000}$ = -1 dB

$C_{tr,50\text{-}3150}$ = -6 dB $C_{tr,50\text{-}5000}$ = -6 dB $C_{tr,100\text{-}5000}$ = -5 dB

Based on the data provided in BS EN 20140-2:1993 it is estimated that the measurement uncertainty should not exceed ±1 dB for the single-number quantity (Rw) and should not exceed the values in Table A1 of BS EN 20140-2:1993 for the data in the individual third octaves (R)

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Normalized impact sound pressure levels according to BS EN ISO 10140-3

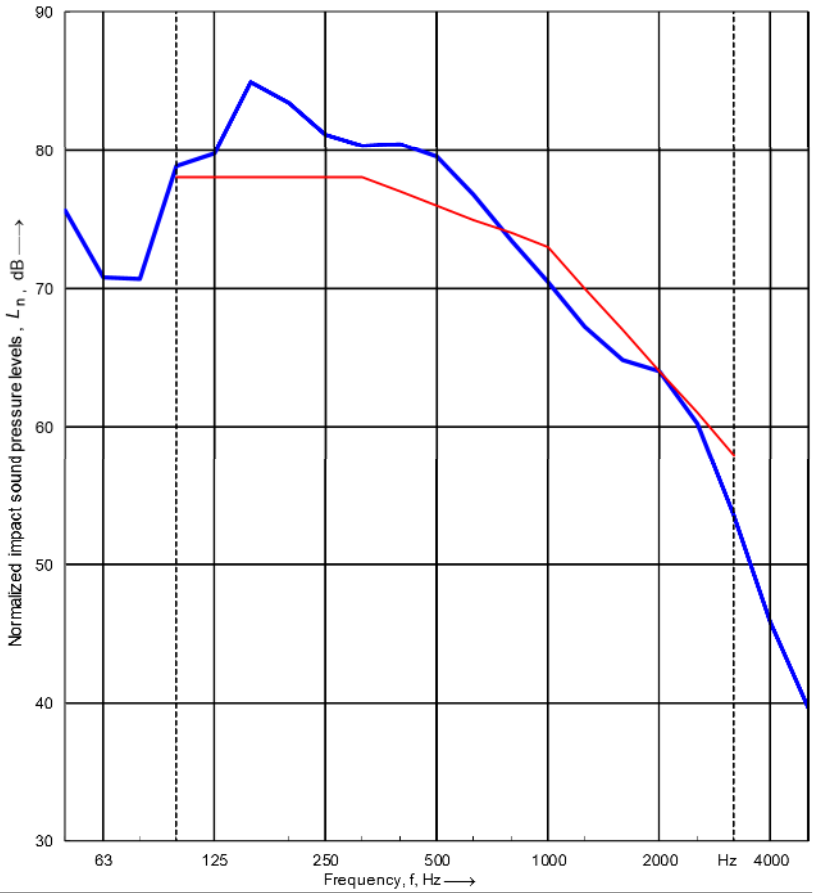
Laboratory measurements of impact sound insulation

Test Laboratory: BRE Transmission Suite (Hall D)
Client: SG Armaturen AS
Date of test: 02/08/2024 **Test Number:** L224-002

Test specimen installed by: BRE
Product identification: Floor Construction
Description of the specimen: Appendix F Floor construction - Impact

Static pressure:	101.9 kPa	**Source room volume:**	112 m³
Air temperature:	22 °C	**Receiving room volume:**	71 m³
Relative air humidity:	50 %	**Area, S, of test element:**	17.9 m³

Frequency f [Hz]	L_n 1/3 octave [dB]
50	75.6
63	70.8
80	70.7
100	78.9
125	79.8
160	84.9
200	83.5
250	81.1
315	80.4
400	80.5
500	79.5
630	76.8
800	73.4
1000	70.5
1250	67.2
1600	64.8
2000	64.0
2500	60.2
3150	53.6
4000	45.9
5000	39.7



Rating according to BS EN ISO 717-2

$L_{n,w}(C_I)$ = 76 (0) dB $C_{I50\text{-}2500}$ = 0 dB

Evaluation based on laboratory measurement results obtained in one- third- octave bands by an engineering method.

Based on the data provided in BS EN 20140-2:1993 it is estimated that the measurement uncertainty should not exceed ±1 dB for the single-number quantity ($L_{n,w}$) and should not exceed the values in Table A1 of BS EN 20140-2:1993 for the data in the individual third octaves (L_n)

Level difference according to BS EN ISO 10140-2

Laboratory measurement of sound insulation of building elements

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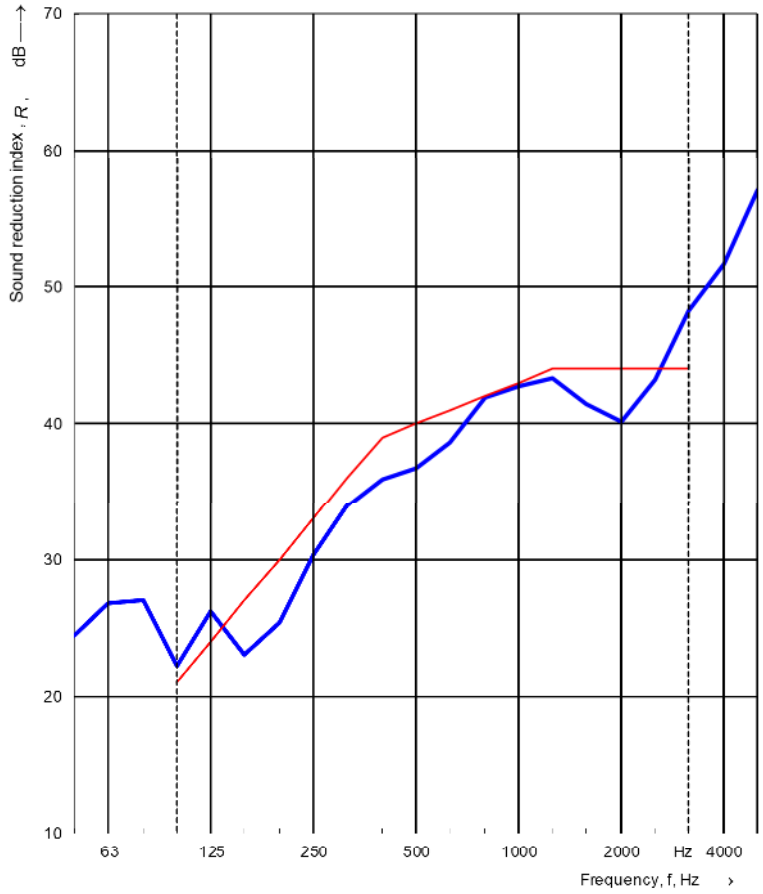
Test Laboratory: BRE Transmission Suite (Hall D)
Client: SG Armaturen AS
Date of test: 20/11/2024 **Test Number:** 224-021
Test specimen installed by: BRE
Product identification: Recessed downlight
Description of the specimen: SG Junistar Eco - HVIT 2700K - without airtight gasket (83 mm cutout)

Static pressure:	100.2 kPa	**Area, S, of test element:**	17.9 m²
Air temperature:	9 °C	**Source room volume:**	112 m³
Relative air humidity:	61 %	**Receiving room volume:**	71 m³

Frequency *f* [Hz]	*R* 1/3 octave [dB]
50	24.4
63	26.8
80	27.0
100	22.2
125	26.2
160	23.0
200	25.4
250	30.3
315	33.9
400	35.9
500	36.8
630	38.6
800	41.9
1000	42.7
1250	43.3
1600	41.5
2000	40.2
2500	43.2
3150	48.3
4000	51.7
5000	57.0



Rating according to ISO 717-1

$R_w(C;C_{tr})$ = 40 (-2 ; -6) dB

Evaluation based on laboratory measurement results obtained in one-third-octave bands by an engineering method.

$C_{50\text{-}3150}$ = -2 dB $C_{50\text{-}5000}$ = -1 dB $C_{100\text{-}5000}$ = -1 dB

$C_{tr,50\text{-}3150}$ = -6 dB $C_{tr,50\text{-}5000}$ = -6 dB $C_{tr,100\text{-}5000}$ = -6 dB

Based on the data provided in BS EN 20140-2:1993 it is estimated that the measurement uncertainty should not exceed ±1 dB for the single-number quantity (Rw) and should not exceed the values in Table A1 of BS EN 20140-2:1993 for the data in the individual third octaves (R)

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Normalized impact sound pressure levels according to BS EN ISO 10140-3

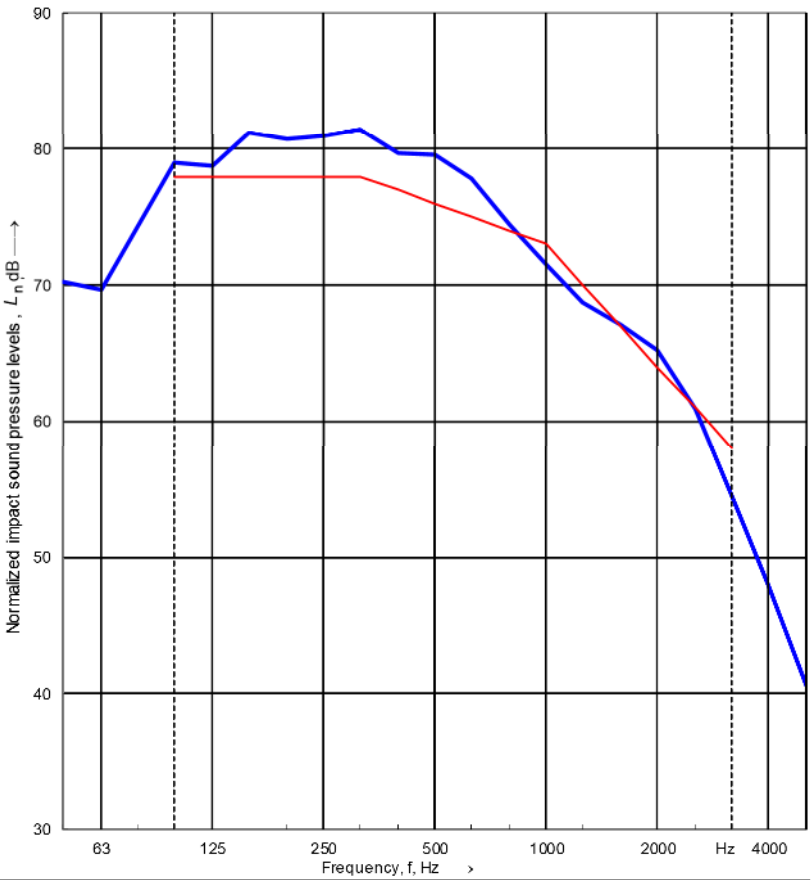
Laboratory measurements of impact sound insulation

Test Laboratory: BRE Transmission Suite (Hall D)
Client: SG Armaturen AS
Date of test: 20/11/2024 **Test Number:** 224-022

Test specimen installed by: BRE
Product identification: Recessed downlight
Description of the specimen: SG Junistar Eco - HVIT 2700K - without airtight gasket (83 mm cutout)

Static pressure:	100.2 kPa	**Source room volume:**	112 m³
Air temperature:	9 °C	**Receiving room volume:**	71 m³
Relative air humidity:	61 %	**Area, S, of test element:**	17.9 m³

Frequency *f* [Hz]	L_n 1/3 octave [dB]
50	70.2
63	69.7
80	74.3
100	79.0
125	78.8
160	81.2
200	80.8
250	81.0
315	81.4
400	79.7
500	79.6
630	77.8
800	74.4
1000	71.5
1250	68.7
1600	67.1
2000	65.2
2500	60.9
3150	54.5
4000	48.0
5000	40.6



Rating according to BS EN ISO 717-2

$L_{n,w}(C_I)$ = 76 (-1) dB $C_{I50\text{-}2500}$ = -1 dB

Evaluation based on laboratory measurement results obtained in one- third- octave bands by an engineering method.

Based on the data provided in BS EN 20140-2:1993 it is estimated that the measurement uncertainty should not exceed ±1 dB for the single-number quantity ($L_{n,w}$) and should not exceed the values in Table A1 of BS EN 20140-2:1993 for the data in the individual third octaves (L_n)

REPORT ENDS