

## Determining the effect of electrical box on sound reduction index of wall structure

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<b>Contact person</b>	<b>Eurofins Expert Services Oy</b> Mika Lojander <a href="mailto:MikaLojander@eurofins.fi">MikaLojander@eurofins.fi</a> Tekniikantie 4 B 02150 Espoo Finland
<b>Assignment</b>	Determining the effect of electrical box on sound reduction index of wall structure.
<b>Sample details</b>	The client supplied samples to the laboratory on the 1.4.2024. Samples were electrical boxes with suitable devices. There were three different sizes of boxes single, 1,5 and double. The structure and details of the samples are illustrated in Appendix 2.
<b>Installation and measuring</b>	<p>The boxes were installed to reference wall element in one or both sides in different configurations. The optimisation of quantity and placement of the boxes were done by client, Appendix 2. Devices, electrical wiring and approx. 500 mm electrical piping were installed to every box. The wall element was installed into the measurement opening (with dimensions 1200 mm x 2140 mm mm) between two reverberation rooms. The wall element was sealed to the opening with mineral wool, sealant mass and wooden beads. The installation procedure is in accordance with <i>EN ISO 10140-1:2021</i> [1]</p> <p>The airborne sound reduction index of the specimen was determined by means of two-channel sound pressure level measurement with two fixed sources and rounding microphones. Senior Technician Ville Joensuu from Eurofins Expert Services Oy carried out the measurements.</p>
<b>Methods</b>	The sound reduction index $R$ was measured in accordance with <i>EN ISO 10140-2:2022</i> [2] and the weighted sound reduction index $R_w$ was determined in accordance with <i>ISO 717-1:2020</i> [3]. Reverberation room dimensions and measuring equipment are presented in Appendix 3.
<b>Results</b>	The results of the measurements are presented in Table 1. The sound reduction index $R$ by 1/3-octaves and different spectrum adaptation terms are presented in Appendix 1.

*Table 1. The weighted sound reduction index  $R_w$  of the wall elements with electrical boxes. The values  $R_w + C$  and  $R_w + C_{tr}$  are also presented.*

Test No.	Type	Structure / boxes	$R_w$ (dB)	$R_w + C$ (dB)	$R_w + C_{tr}$ (dB)
1.	Reference (Wall 1)	2 x gypsum board (13 mm) / 95 mm acoustic wool (15kg/m <sup>3</sup> ) / 2 x gypsum board (13 mm) / 95 mm metal studs.	53	51	47
2.	One side (Wall 2)	6 x single / 1 x 1,5 / 1 x double	53	51	46
3.	Both sides displacement 200mm (Wall 3)	Source room: 6 x single / 1 x 1,5 / 1 x double Receiving room: 6 x single / 1 x 1,5 / 1 x double	52	51	46
4.	Both sides back to back (Wall 4)	Source room: 6 x single / 1 x 1,5 / 1 x double Receiving room: 6 x single / 1 x 1,5 / 1 x double	51	49	45

According to ISO 717-1:2020 Annex A the single-number sound insulation quantity  $R_w + C_{tr}$  is regarded suitable for example in the case of the urban road traffic noise and  $R_w + C$  for the noise of the jet aircraft (short distance). The sound reduction index R by 1/3-octaves is presented in Appendix 1.

In laboratories, a repeatability of 1 dB is normally achievable for single-number quantities [1].

**Espoo, 26.6.2024**

*Mika Lojander*

Expert

**The report is electronically signed.**

*Eurofins Expert Services Oy is notified body No. NB 0809*

**References**

*FINAS Finnish Accreditation Service has accredited our laboratory (T001, Eurofins Expert Services Oy) to perform measurements according to standards listed below.*

[1] *EN ISO 10140-1:2021 Acoustics - Laboratory measurement of sound insulation of building elements - Part 1: Application rules for specific products*

[2] *ISO 10140-2:2022 Acoustics - Measurement of sound insulation in buildings and of building elements - Part 2: Laboratory measurements of airborne sound insulation of building elements*

[3] *ISO 717-1:2020 Acoustics - Rating of sound insulation in buildings and of building elements – Part 1: Airborne sound insulation*

Appendices 3

Distribution Customer, electronically approved

Client: SG Armaturen AS

Product identification: 1 Solid wall

Test specimen mounted by: Client  
Date of test: 17.5.2024

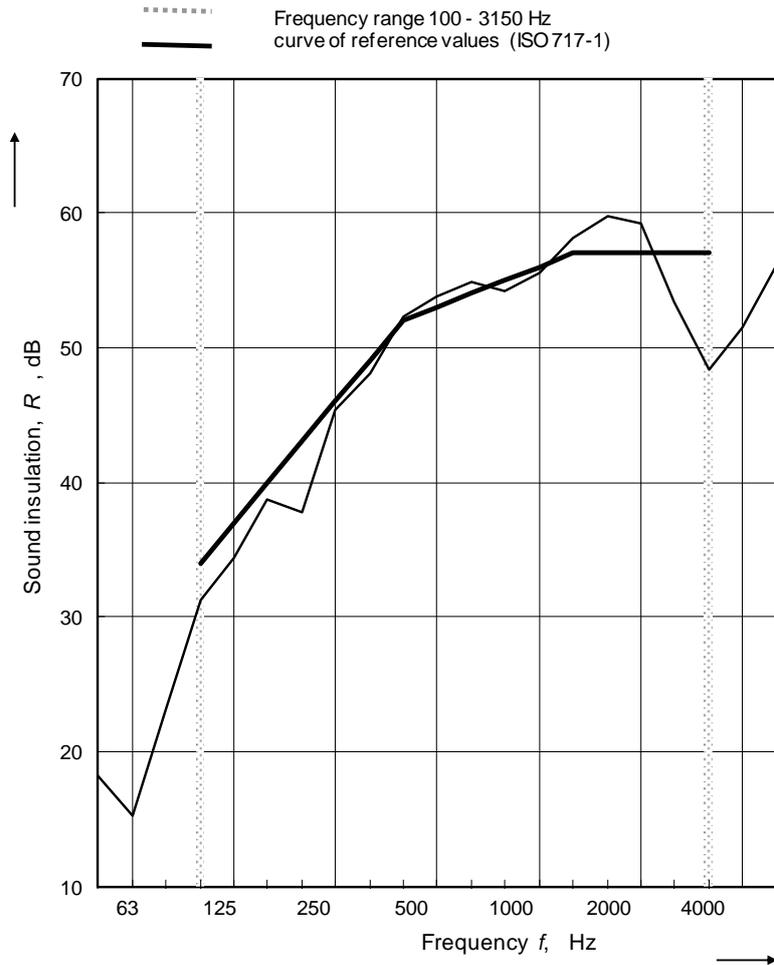
Construct: 2 x gypsum board (13 mm)  
95 mm acoustic wool (15kg/m3)  
2 x gypsum board (13 mm)  
Metal profiles (95mm)  
Stud spacing 600 mm

Description of test specimen and test conditions:

Areas of test specimen: 2,6 m<sup>2</sup>  
Air temp. in the test rooms: 20,8 °C  
Air humidity in the test rooms: 46,8 %  
Barometric pressure: 103 kPa  
Source room volume: 102 m<sup>3</sup>  
Receiving room volume: 131 m<sup>3</sup>

Size: 1200 x 2140 mm

<i>f</i> Frequency Hz	<i>R</i> One-third octave dB
50	18,2
63	15,2
80	23,1
100	31,2
125	34,3
160	38,7
200	37,8
250	45,4
315	48,1
400	52,3
500	53,8
630	54,9
800	54,2
1000	55,5
1250	58,1
1600	59,7
2000	59,2
2500	53,4
3150	48,3
4000	51,5
5000	56,2



Rating according to ISO 717-1: $R_w(C;C_{tr}) = 53 (-2; -6) \text{ dB};$	$C_{50-3150} = -6 \text{ dB};$	$C_{50-5000} = -5 \text{ dB};$	$C_{100-5000} = -2 \text{ dB};$
Evaluation based on laboratory measurement results obtained by an engineering method:	$C_{tr,50-3150} = -17 \text{ dB};$	$C_{tr,50-5000} = -17 \text{ dB};$	$C_{tr,100-5000} = -6 \text{ dB};$

Client: SG Armaturen AS

Product identification: 2 Test wall 2

Boxes source room: 6 x single, 1 x 1,5 and 1 x double

Test specimen mounted by: Client

Boxes installed source room side.

Date of test: 17.5.2024

All boxes had devices and approx. 50 cm electrical piping and wiring.

Description of test specimen and test conditions:

Areas of test specimen: 2,6 m<sup>2</sup>

Construct: 2 x gypsum board (13 mm)

Air temp. in the test rooms: 20,8 °C

95 mm acoustic wool (15kg/m<sup>3</sup>)

Air humidity in the test rooms: 46,8 %

2 x gypsum board (13 mm)

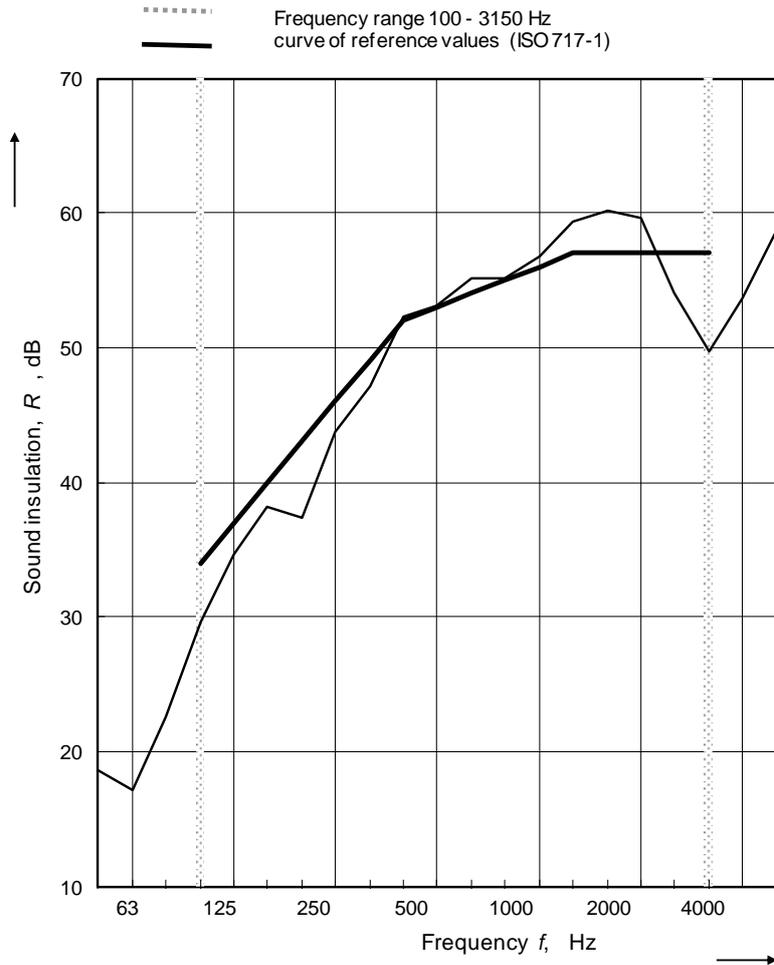
Barometric pressure: 103 kPa

Metal profiles (95mm), Stud spacing 600 mm

Source room volume: 102 m<sup>3</sup>

Receiving room volume: 131 m<sup>3</sup>

<i>f</i> Frequency Hz	<i>R</i> One-third octave dB
50	18,6
63	17,1
80	22,6
100	29,6
125	34,7
160	38,1
200	37,4
250	43,8
315	47,1
400	52,3
500	53,1
630	55,2
800	55,2
1000	56,7
1250	59,4
1600	60,2
2000	59,6
2500	54,1
3150	49,7
4000	53,6
5000	58,8



Rating according to ISO 717-1: $R_w(C;C_{tr}) = 53 (-2; -7) \text{ dB};$	$C_{50-3150} = -5 \text{ dB};$	$C_{50-5000} = -5 \text{ dB};$	$C_{100-5000} = -2 \text{ dB};$
Evaluation based on laboratory measurement results obtained by an engineering method:	$C_{tr,50-3150} = -16 \text{ dB};$	$C_{tr,50-5000} = -16 \text{ dB};$	$C_{tr,100-5000} = -7 \text{ dB};$

Client: SG Armaturen AS

Product identification: 3 Test wall 3

Boxes source room: 6 x single, 1 x 1,5 and 1 x double

Boxes receiving room: 6 x single, 1 x 1,5 and 1 x double

Test specimen mounted by: Client

Date of test: 17.5.2024

Boxes installed with displacement of 200 mm

All boxes had devices and approx. 50 cm electrical piping and wiring.

Description of test specimen and test conditions:

Areas of test specimen: 2,6 m<sup>2</sup>

Air temp. in the test rooms: 20,8 °C

Air humidity in the test rooms: 46,8 %

Barometric pressure: 103 kPa

Source room volume: 102 m<sup>3</sup>

Receiving room volume: 131 m<sup>3</sup>

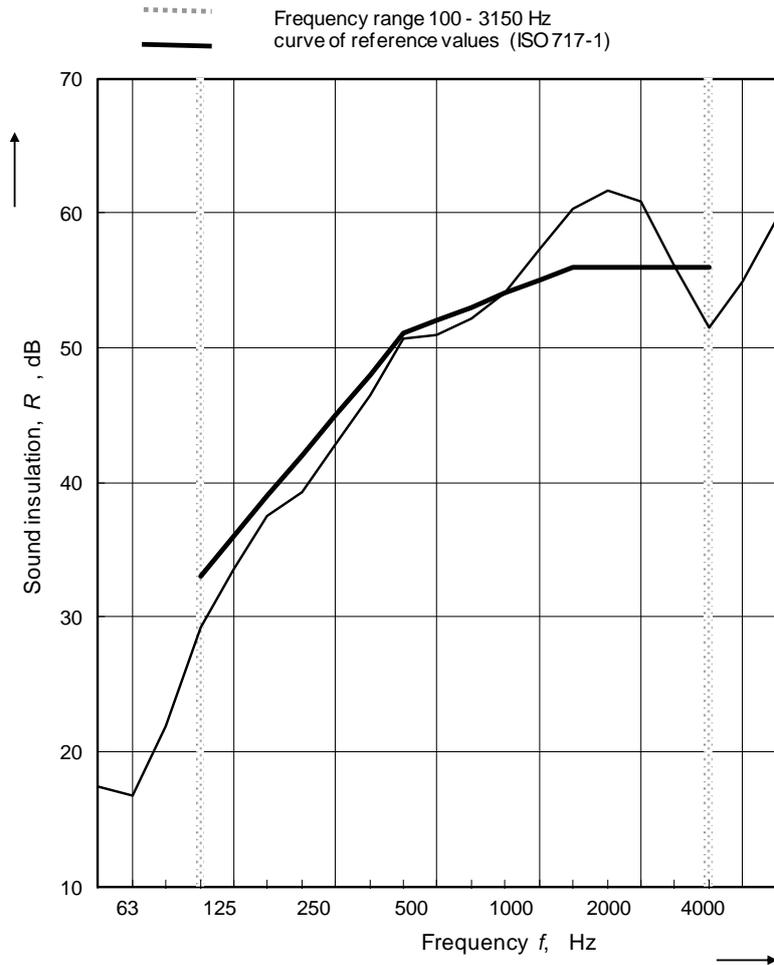
Construct: 2 x gypsum board (13 mm)

95 mm acoustic wool (15kg/m<sup>3</sup>)

2 x gypsum board (13 mm)

Metal profiles (95mm), Stud spacing 600 mm

<i>f</i> Frequency Hz	<i>R</i> One-third octave dB
50	17,4
63	16,7
80	21,9
100	29,2
125	33,6
160	37,5
200	39,2
250	42,8
315	46,4
400	50,6
500	50,9
630	52,2
800	54,0
1000	57,3
1250	60,3
1600	61,7
2000	60,9
2500	56,1
3150	51,5
4000	54,9
5000	59,6



Rating according to ISO 717-1: $R_w(C;C_{tr}) = 52 (-1; -6) \text{ dB};$	$C_{50-3150} = -5 \text{ dB};$	$C_{50-5000} = -4 \text{ dB};$	$C_{100-5000} = -1 \text{ dB};$
Evaluation based on laboratory measurement results obtained by an engineering method:	$C_{tr,50-3150} = -16 \text{ dB};$	$C_{tr,50-5000} = -16 \text{ dB};$	$C_{tr,100-5000} = -6 \text{ dB};$

Client: SG Armaturen AS

Product identification: 4 Test wall 4

Boxes source room: 6 x single, 1 x 1,5 and 1 x double  
Boxes receiving room: 6 x single, 1 x 1,5 and 1 x double

Test specimen mounted by: Client  
Date of test: 17.5.2024

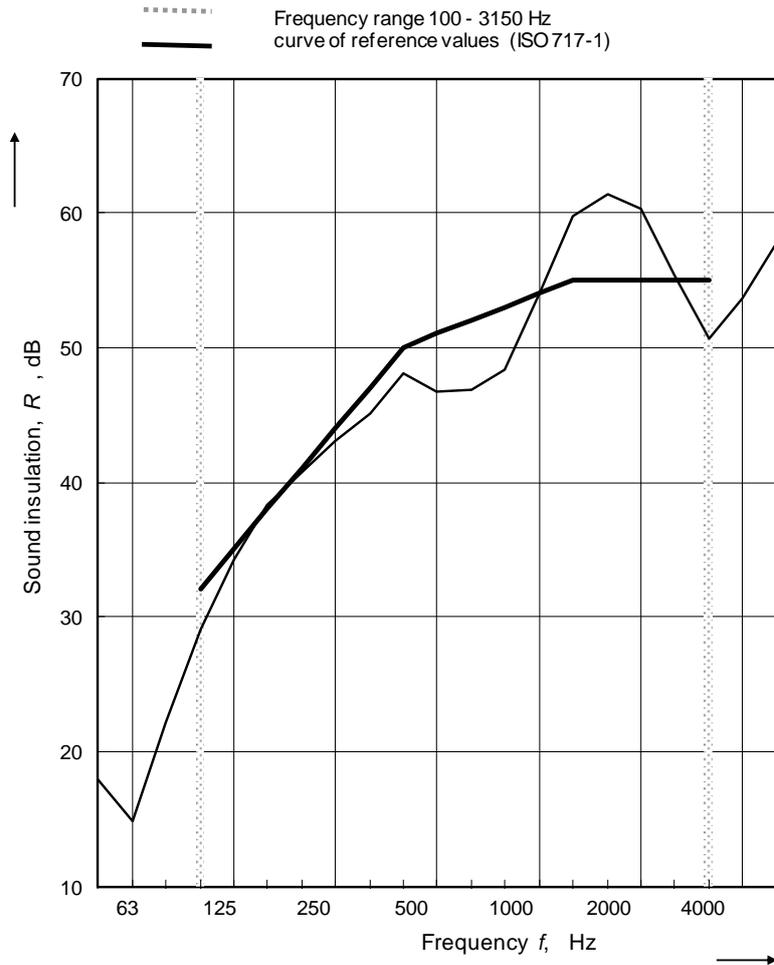
Boxes installed back to back  
All boxes had devices and approx. 50 cm electrical piping and wiring.

Description of test specimen and test conditions:

Areas of test specimen: 2,6 m<sup>2</sup>  
Air temp. in the test rooms: 20,8 °C  
Air humidity in the test rooms: 46,8 %  
Barometric pressure: 103 kPa  
Source room volume: 102 m<sup>3</sup>  
Receiving room volume: 131 m<sup>3</sup>

Construct: 2 x gypsum board (13 mm)  
95 mm acoustic wool (15kg/m<sup>3</sup>)  
2 x gypsum board (13 mm)  
Metal profiles (95mm), Stud spacing 600 mm

<i>f</i> Frequency Hz	<i>R</i> One-third octave dB
50	17,9
63	14,8
80	22,1
100	29,1
125	34,2
160	38,3
200	40,8
250	43,0
315	45,1
400	48,1
500	46,7
630	46,9
800	48,3
1000	54,0
1250	59,8
1600	61,4
2000	60,3
2500	55,4
3150	50,7
4000	53,6
5000	57,9

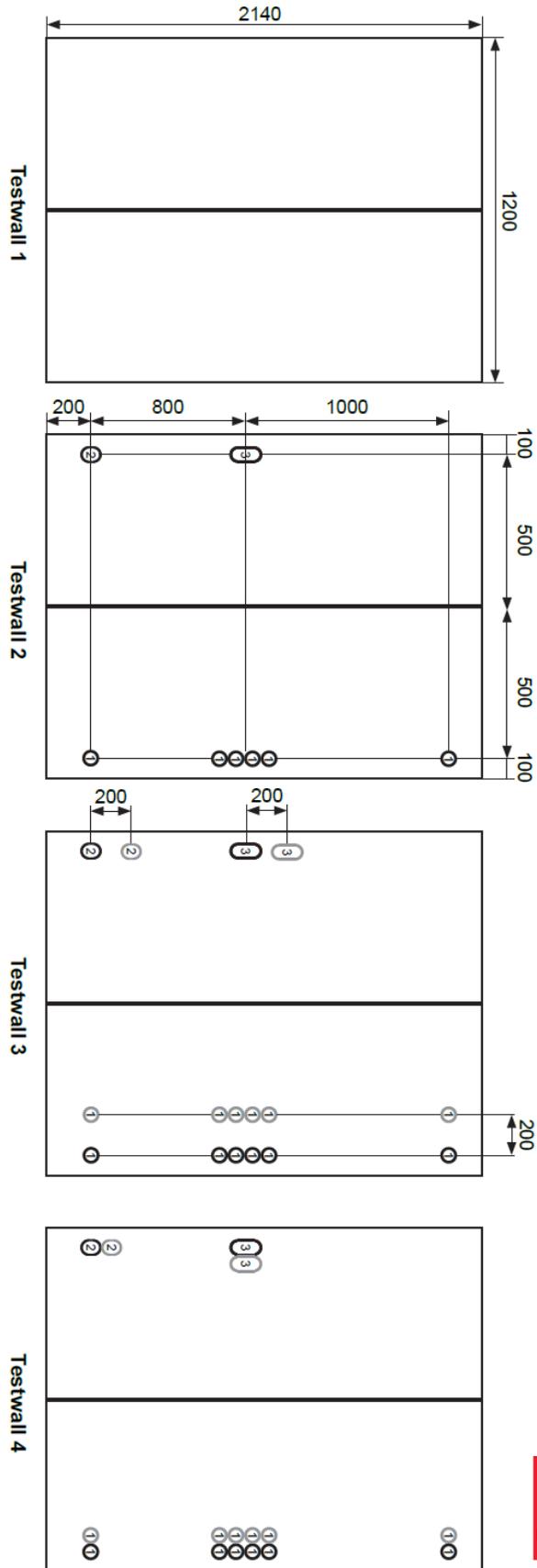


Rating according to ISO 717-1: $R_w(C;C_{tr}) = 51 (-2; -6) \text{ dB};$	$C_{50-3150} = -5 \text{ dB};$	$C_{50-5000} = -4 \text{ dB};$	$C_{100-5000} = -1 \text{ dB};$
Evaluation based on laboratory measurement results obtained by an engineering method:	$C_{tr,50-3150} = -16 \text{ dB};$	$C_{tr,50-5000} = -16 \text{ dB};$	$C_{tr,100-5000} = -6 \text{ dB};$

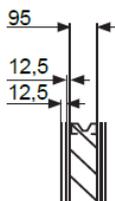
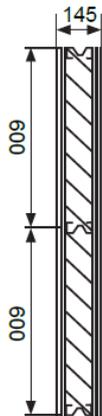


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SG Wallboxes sound penetration test



Wall description  
 Testwall 1: Reference wall without installed boxes  
 Testwall 2: with installed boxes on one side of the wall  
 Testwall 3: with boxes on both sides of the wall with 200mm displacement  
 Testwall 4: with boxes installed back to back



Drawing	SKU	Description	Quantity	Url
①	79010 / 1202569	Veggboks Grå Enkel 21.36mm 8-löp sländer metall	18	<a href="https://www.sg-as.com/hb/produktler/veggbok/s/1202569">https://www.sg-as.com/hb/produktler/veggbok/s/1202569</a>
②	79011 / 1202570	Veggboks Grå 1.5.21/24mm 6-löp sländer Vertikal	15	<a href="https://www.sg-as.com/hb/produktler/veggbok/s/1202570">https://www.sg-as.com/hb/produktler/veggbok/s/1202570</a>
③	79002 / 1202590	Veggboks Grå Dobbel 9/12mm 6-löp sländer Vertikal	5	<a href="https://www.sg-as.com/hb/produktler/veggbok/s/1202590">https://www.sg-as.com/hb/produktler/veggbok/s/1202590</a>



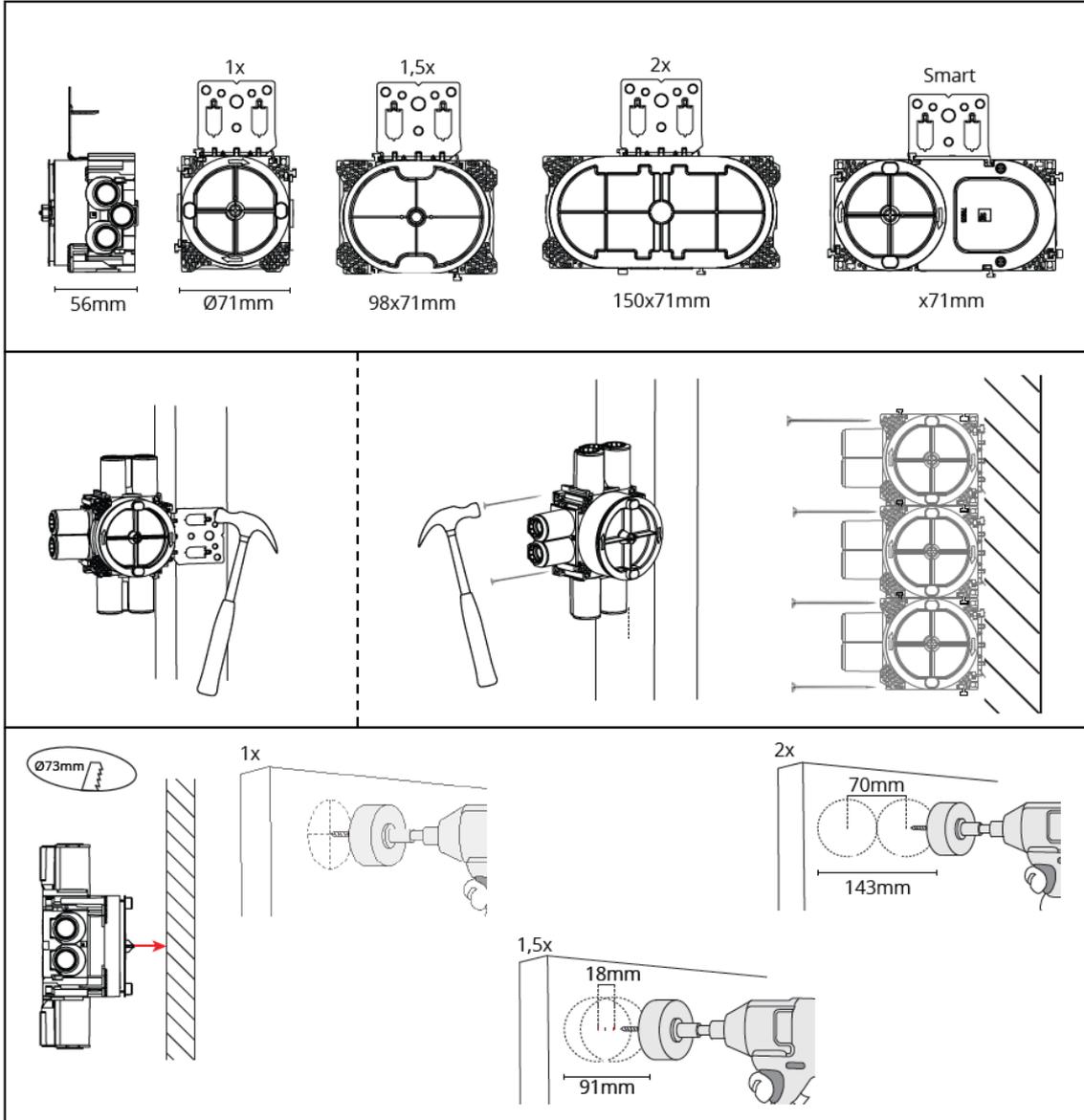
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# Veggboks, Built-in wallbox, Aparatdosa

IP30

Ha -25°C~90°C



Rev: 07.04.2022

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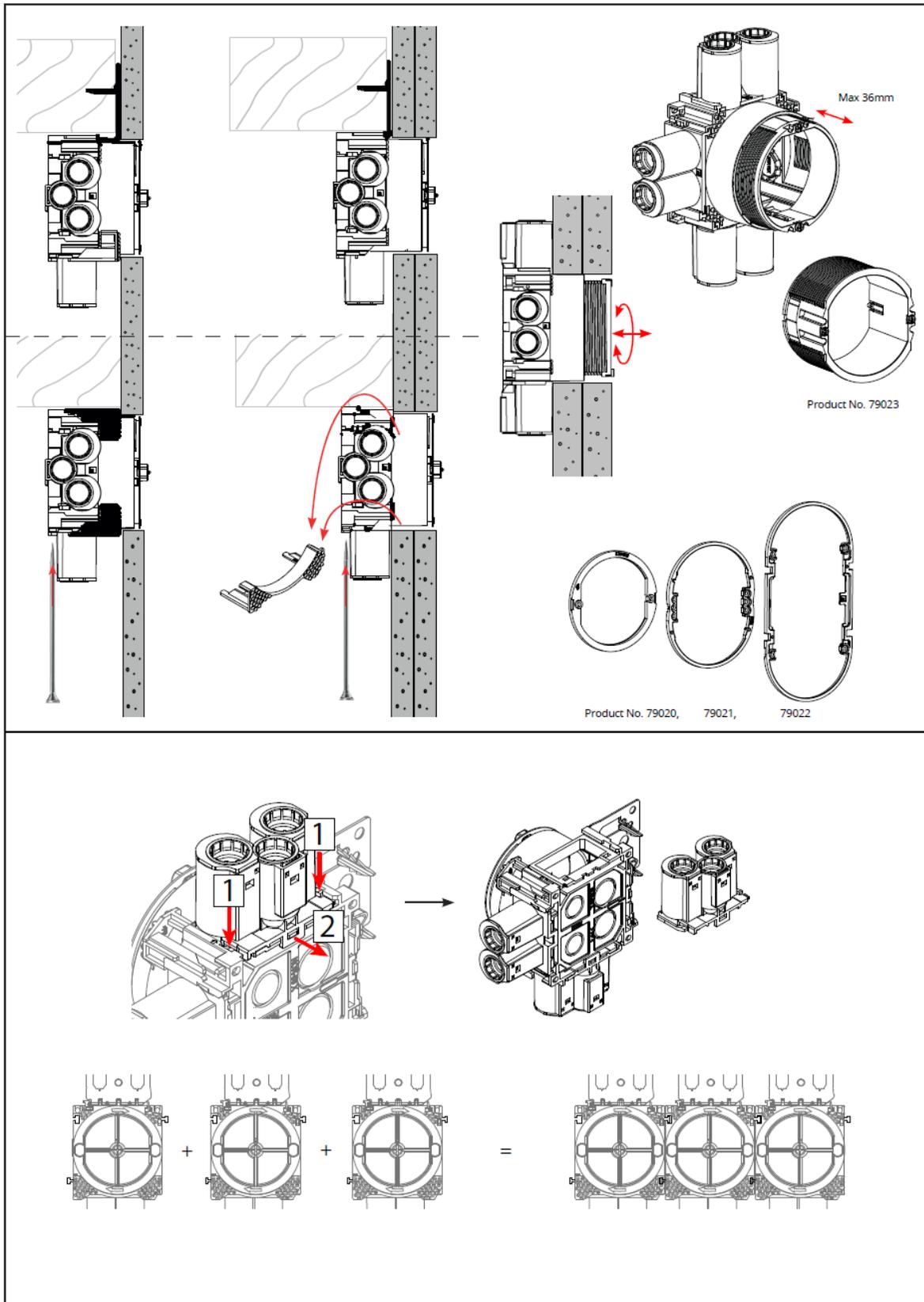
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# Stikkontakt, Outlet, Uttag, Pistorasia



50/60Hz, 250V~, Max 16A

<p><b>NO:</b> Skru av strømmen før montering.  <b>DK:</b> Sluk for strømmen inden montering.  <b>SE:</b> Stäng av strömmen innan montering.  <b>EN:</b> Turn off power before installing.  <b>FR:</b> Couper le courant avant l'installation.  <b>NL:</b> Stroom uitschakelen voor u het toestel installeert.  <b>DE:</b> Vor Installationsarbeiten den Strom abschalten.  <b>FI:</b> Sammuta virta ennen kytkemistä</p> <p><b>NO:</b> Kan kun installeres og vedlikeholdes av en registrert installasjonsvirksomhet.  <b>DK:</b> Må kun installeres og vedligeholdes af uddannet elektriker.  <b>SE:</b> Skall installeras och underhållas av behörig elektriker.  <b>EN:</b> Only to be installed and maintained by an authorized electrician.  <b>FR:</b> Doit être installé et maintenu par un électricien qualifié.  <b>NL:</b> Mag alleen geïnstalleerd en onderhouden worden door een bevoegde electricien.  <b>DE:</b> Dieses Produkt darf nur durch autorisiertes Personal (z.B. Elektroinstallateur) angeschlossen, in Betrieb genommen und gewartet werden.  <b>FI:</b> Asentaa ja huoltaa saa vain valtuutettu sähköasentaja</p>		
1	2	3
4	5	

Rev: 14.10.2021

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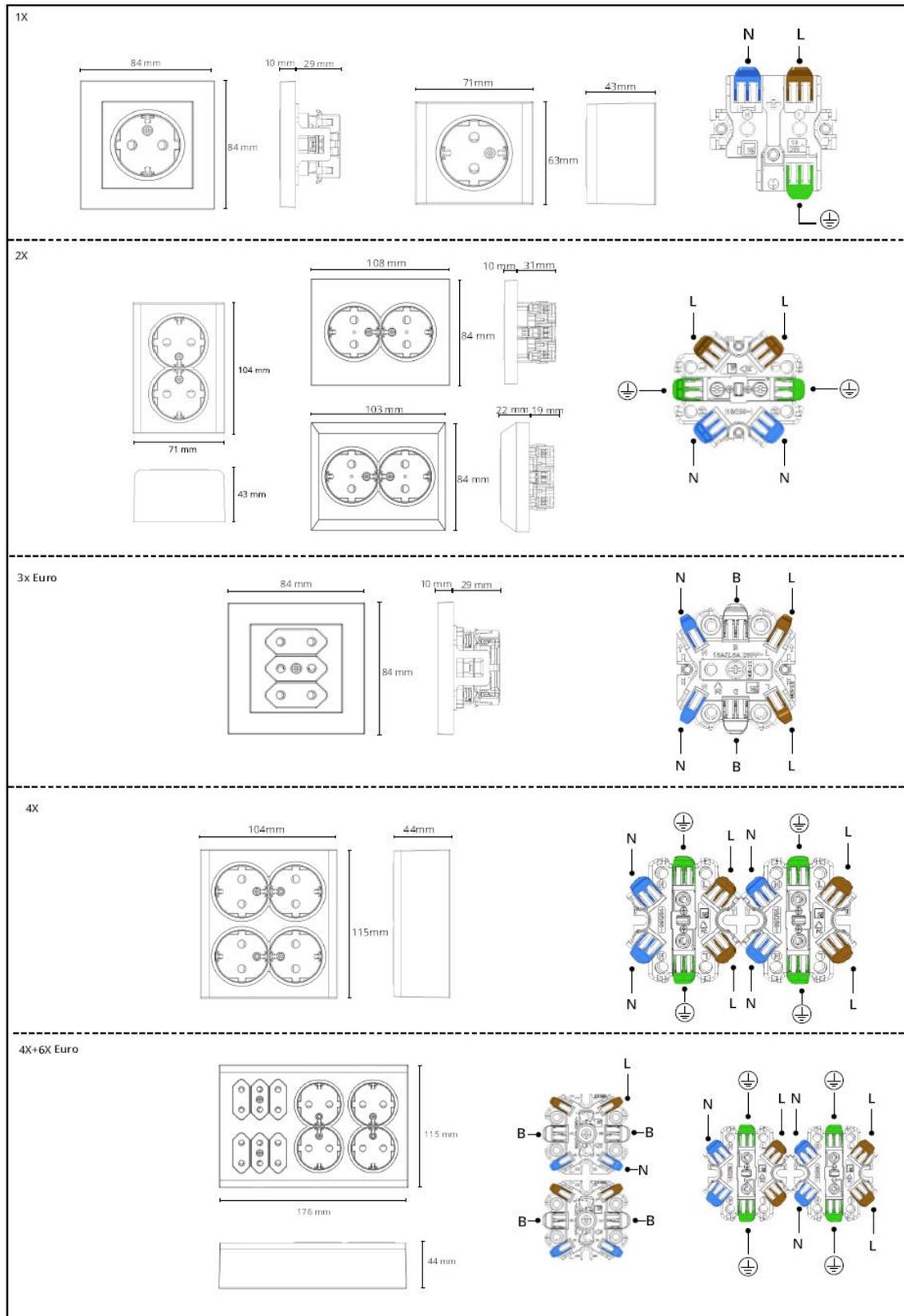
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# Bryter, Switch, Strömställare, Kytkin

IP21

50/60Hz, 16-10X/250V~

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1	2	3
4	5	6

Rev: 03.06.2022

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<p>84 mm, 10 mm, 14 mm, 84 mm, 71 mm, 24 mm, 84 mm</p>	
<p><b>Type 1</b> NO: 1 pol EN: 1 pole SE: 1 pol FI: 1-nap</p>	<p><b>Type 2</b> NO: 2 pol EN: 2 pole SE: 2 pol FI: 2-nap</p>
<p><b>Type 5</b> NO: 1+1 pol EN: 1+1 pole SE: Kron FI: 1+1 nap</p>	<p><b>Type 6</b> NO: Endeender EN: Two-way SE: Trapp FI: Vaihto</p>
<p><b>Type 6+6</b> NO: Dobbel endeender EN: Double two-way SE: Dubbel trapp FI: Vaihto+Vaihto</p>	<p><b>Type 7</b> NO: Mellomvender EN: Reversing SE: Kors FI: Risti</p>
<p><b>Type 2+1</b> NO: 2+1 pol EN: 2+1 pole SE: 2+1 pol FI: 2+1 nap</p>	<p><b>Type 1+1+1</b> NO: 1+1+1 pol EN: 1+1+1 pole SE: 3x1 pol FI: 1+1+1-nap</p>
<p><b>Type 4T</b> NO: markise EN: shutters SE: markis FI: markiisi</p>	<p><b>NO: Vekselvendersystem</b> <b>EN: Two way reversing combination</b> <b>SE: Trapp+kors</b> <b>FI: Vaihto+ risti</b></p> <p>Type 6    Type 7    Type 7    Type 6</p>

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# LEDDim 350

DIGITAL TRAILING EDGE DIMMER



220-240V, 50/60Hz, 3-350VA, -20°C to 35°C

Single dimmer wiring

Two-way switch wiring

**NO:** Minimum dimmenivåjustering  
**DA:** Minimum justering af dæmpningsniveau  
**SE:** Minsta justering av dimmningsnivå  
**EN:** Minimum dimming level adjustment  
**FR:** Réglage du niveau de gradation minimal  
**NL:** Regelbaar niveau van minimale dimmingsgraad  
**DE:** Anpassung der minimalen Dimmstufe  
**FI:** Minimi himmennystaso

**NO:** Maksimum dimmenivåjustering  
**DA:** Maximum justering af dæmpningsniveau  
**SE:** Max justering av dimmningsnivå  
**EN:** Maximum dimming level adjustment  
**FR:** Réglage du niveau de gradation maximal  
**NL:** Regelbaar niveau van maximale dimmingsgraad  
**DE:** Anpassung der maximalen Dimmstufe  
**FI:** Max himmennystaso

**\*\* Max. load**

Load type	R	C	R+C	L
① Single dimmer	Max. 350W	Max. 280W	Max. 280W	X
② Two or more dimmers	Max. 260W/pc.	Max. 210W/pc.	Max. 210W/pc.	X

Rev:14.06.2023

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Picture1 & 2. Electrical boxes installed to wall element with and without devices.

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## Measuring equipment and reverberation room dimensions

Measuring equipment	Name	Serial No.
Condenser microphone	B&K (Brüel&Kjær) 4134	2415044
Condenser microphone	B&K (Brüel&Kjær) 4134	2527717
Microphone preamplifier	B&K 2639	2025241
Microphone preamplifier	B&K 2639	2554550
Rotating microphone boom	B&K 3923	1678216
Rotating microphone boom	B&K 3923	2630663
Power amplifier	Yamaha MX-1000	
Loudspeakers	Sinmarc V121L	
Real-time analyser	Norsonic 121	31429
Sound calibrator	B&K 4228	3063558

Reverberation room dimensions	Floor	Height	Volume
Source room	4.7 m x 5.8 m	3.7 m	102 m <sup>3</sup>
Receiving room	5.0 m x 6.5 m	4.0 m	131 m <sup>3</sup>

Thickness of the concrete walls, floors and ceilings of the reverberation rooms is 0.25 m