Vibration Isolation
Heavy-Duty Impact
Sound Insulation

Product Overview

Introduction to the Topic
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The currently valid versions of this information are provided on our internet pages and in the PDF versions of this catalogue. The PDF versions are available to download from our website.

Our current terms and conditions of business can be found on our website.
The Skybar in Liverpool and the Palaisquartier in Frankfurt am Main are only two of the many buildings in which BSW vibration control technology and impact sound insulation are used.
Regupol® and Regufoam® for heavy-duty impact sound insulation and vibration isolation is used in buildings with very high technical and acoustic requirements: in the Hamburg Elbphilharmonie, in the RTL studios in Cologne, the Wisseloord Studios in Hilversum, The Shard in London, the European Union’s highest building, and the Audi plant in Győr, Hungary.

Detailed discussions of these and further projects can be found at

www.bsw-vibration-technology.com
Regufoam® vibration is a mixed cell polyurethane foam for vibration isolation. It is available in 12 different qualities.

Standard forms of delivery, ex warehouse
Rolls for types 150, 190, 220, 270, 300
Thickness: 12 and 25 mm, special thicknesses on request
Length: 5,000 mm, special lengths available
Width: 1,500 mm

Plates for types 400, 510, 570, 680, 740, 810, 990
Thickness: 12 and 25 mm, special thicknesses on request
Length: 1,500 mm
Width: 1,000 mm

Stripping/Plates
On request
Die-cutting, water-jet cutting, self-adhesive versions possible

Brief Overview of the Technical Data

<table>
<thead>
<tr>
<th>Regufoam® vibration</th>
<th>Colour</th>
<th>150 plus</th>
<th>190 plus</th>
<th>220 plus</th>
<th>270 plus</th>
<th>300 plus</th>
<th>400 plus</th>
<th>510 plus</th>
<th>570 plus</th>
<th>680 plus</th>
<th>740 plus</th>
<th>810 plus</th>
<th>990 plus</th>
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<tr>
<td>Colour</td>
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<td>Green</td>
<td>Yellow</td>
<td>Purple</td>
<td>Blue</td>
<td>Black</td>
<td>Grey</td>
<td>Beige</td>
<td>Rose</td>
<td>Turquoise</td>
<td>Red</td>
<td>Brown</td>
<td>Orange</td>
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<tr>
<td>Permanent static load</td>
<td>N/mm²</td>
<td>0.011</td>
<td>0.018</td>
<td>0.028</td>
<td>0.042</td>
<td>0.055</td>
<td>0.11</td>
<td>0.22</td>
<td>0.30</td>
<td>0.45</td>
<td>0.60</td>
<td>0.85</td>
<td>2.50</td>
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<tr>
<td>Optimum load range</td>
<td>N/mm²</td>
<td>0.004</td>
<td>0.011</td>
<td>0.018</td>
<td>0.028</td>
<td>0.042</td>
<td>0.055</td>
<td>0.11</td>
<td>0.22</td>
<td>0.30</td>
<td>0.45</td>
<td>0.60</td>
<td>0.85</td>
</tr>
<tr>
<td>Tensile strength</td>
<td>N/mm²</td>
<td>0.31</td>
<td>0.4</td>
<td>0.5</td>
<td>0.9</td>
<td>1.2</td>
<td>1.5</td>
<td>2.4</td>
<td>2.9</td>
<td>3.6</td>
<td>4.0</td>
<td>4.6</td>
<td>6.9</td>
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<td>0.28</td>
<td>0.25</td>
<td>0.22</td>
<td>0.20</td>
<td>0.18</td>
<td>0.17</td>
<td>0.15</td>
<td>0.14</td>
<td>0.12</td>
<td>0.11</td>
<td>0.10</td>
<td>0.09</td>
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<tr>
<td>Static modulus of elasticity</td>
<td>N/mm²</td>
<td>0.06 to 0.16</td>
<td>0.1 to 0.25</td>
<td>0.15 to 0.35</td>
<td>0.25 to 0.45</td>
<td>0.35 to 0.58</td>
<td>0.6 to 1.0</td>
<td>1.1 to 1.7</td>
<td>2.6 to 2.7</td>
<td>2.0 to 2.9</td>
<td>4.3 to 5.9</td>
<td>5.8 to 7.2</td>
<td>20.0 to 78.0</td>
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<tr>
<td>Dynamic modulus of elasticity</td>
<td>N/mm²</td>
<td>0.15 to 0.38</td>
<td>0.25 to 0.55</td>
<td>0.35 to 0.75</td>
<td>0.60 to 1.05</td>
<td>0.68 to 1.25</td>
<td>1.2 to 2.0</td>
<td>2.2 to 3.7</td>
<td>5.1 to 6.3</td>
<td>6.8 to 10.0</td>
<td>7.9 to 13.0</td>
<td>11.0 to 16.5</td>
<td>41.0 to 160.0</td>
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<tr>
<td>Compression hardness</td>
<td>kPa</td>
<td>14</td>
<td>22</td>
<td>22</td>
<td>63</td>
<td>82</td>
<td>170</td>
<td>330</td>
<td>620</td>
<td>840</td>
<td>1050</td>
<td>1241</td>
<td>3640</td>
</tr>
</tbody>
</table>

1 Measurement based on DIN EN ISO 1798
2 Measurement based on DIN 53513; load-, amplitude- and frequency-dependent.
3 Measurement based on EN 826.
4 Measurement based on DIN 53513; depending on frequency, load and thickness.
5 Measurement based on DIN EN ISO 3386-2; compressive stress at 25% deformation, depending on thickness.

Technical services and offers based on these are subject to our General Terms and Conditions of sale. In so far, please be advised as follows: Our expertise is the development and manufacturing of products. With our recommendation we can only assist you in selecting a product that is suitable for your demand. However, we cannot act as your architect or consulting expert. This would only be possible subject to a separately concluded service contract that we would have to bill you for. Such contracts are not part of our scope of supply and services. Hence, our recommendation does not lay claim for its correctness. Guarantees do only apply to the technical properties of the material supplied. All given values are approximate values.
Regufoam® – Mixed-Cell Polyurethane Elastomers

Material Composition

Regufoam® elastomers consist of a mixed-cell polyurethane foam. Similar to the various Regupol® types, Regufoam® isolation materials have been precisely designed for different load ranges. Various standard thicknesses of 12 mm, 25 mm, 37 mm and 50 mm cover a wide spectrum of support frequencies up to 8 Hz.

The successful use of polyurethanes in vibration isolation over the course of many years offers expert consultants a conventional solution and a valuable alternative to Regupol® elastomers.

Moreover, the BSW test lab offers the option of developing project- and application-specific elastomers with special properties.

Regufoam® elastomers and their specific load ranges can be distinguished from one another using colour codes (green, yellow, purple, blue, black, grey, beige, rose, turquoise, red, brown, orange).

Effectiveness of the Regufoam® Elastomers

Regufoam® elastomers can be specifically set for support frequencies between 20 Hz and 8 Hz in a broad load range from 0.011 N/mm² to 2.50 N/mm². Expert consultants in particular benefit from this large degree of flexibility.

The use of polyurethanes in vibration isolation over the course of many years offers expert consultants a conventional solution and valuable alternative. The admissible continuous load limits must be kept, as overload on the elastomers may lead to creep as well as rigidification of the material.

Regufoam® elastomers are produced and shipped in rolls. They can be cut to size with a standard utility knife right at the construction site. The professional company at the construction site is thus ensured that the installation is going to be simple, quick and, above all, cost-efficient.

Possible Uses

Regufoam® elastomers are suitable for a large range of applications in which insulation against vibration is required.

Due to their different dynamic rigidities and admissible load ranges, building and machine foundations can be placed elastically on strips or delicate point supports. Due to the low support frequencies, this type of support is technically efficient, but more difficult to plan and execute.

The majority of isolation jobs are performed on full-surface Regufoam® elastomers with lower rigidity, because this is more feasible and less error-prone.

The technical details, clearly arranged and determined as well as tested by the Technical University Dresden, among other institutions, provide a full overview of the load range of the Regufoam® elastomers and their non-linear material properties. They allow expert consultants to select and properly size the elastomer type that suits the situation at hand and meets its respective requirements.

Regufoam® elastomers are moisture- and rot-resistant. They are also ozone-resistant, but the colours may fade over time due to UV radiation. Because of their mixed-cell structure, especially types with lower dynamic rigidity can absorb water. These must be protected against water uptake.
Regupol® vibration is a rubber-polyurethane-composite for vibration isolation. It is available in 8 different qualities.

Standard forms of delivery, ex warehouse
Depending on material. Exact dimensions are mentioned in the technical data sheets of each material type.

Stripping/Plates
On request
Die-cutting, water-jet cutting, self-adhesive versions possible

Regupol® vibration is used for vertical isolation.

Brief Overview of the Technical Data

<table>
<thead>
<tr>
<th>Regupol® vibration</th>
<th>200</th>
<th>300</th>
<th>400</th>
<th>450</th>
<th>480</th>
<th>550</th>
<th>800</th>
<th>1000</th>
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</thead>
<tbody>
<tr>
<td>Permanent static load N/mm²</td>
<td>0.02</td>
<td>0.05</td>
<td>0.10</td>
<td>0.12</td>
<td>0.15</td>
<td>0.30</td>
<td>0.80</td>
<td>1.50</td>
</tr>
<tr>
<td>Optimum load range N/mm²</td>
<td>0.004 to 0.014</td>
<td>0.010 to 0.050</td>
<td>0.050 to 0.10</td>
<td>0.10 to 0.15</td>
<td>0.15 to 0.20</td>
<td>0.20 to 0.40</td>
<td></td>
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</tr>
<tr>
<td>Tensile strength N/mm²</td>
<td>0.12</td>
<td>0.30</td>
<td>0.34</td>
<td>0.15</td>
<td>0.36</td>
<td>0.60</td>
<td>0.90</td>
<td>2.30</td>
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<tr>
<td>Mechanical loss factor²</td>
<td>0.22</td>
<td>0.18</td>
<td>0.17</td>
<td>0.2</td>
<td>0.17</td>
<td>0.16</td>
<td>0.18</td>
<td>0.16</td>
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<tr>
<td>Static modulus of elasticity³ N/mm²</td>
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<td>0.1 to 0.2</td>
<td>0.3 to 0.55</td>
<td>0.2 to 0.4</td>
<td>0.25 to 0.4</td>
<td>0.5 to 0.8</td>
<td>1.2 to 1.7</td>
<td>2.9 to 4.0</td>
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<tr>
<td>Dynamic modulus of elasticity⁴ N/mm²</td>
<td>0.05 to 0.38</td>
<td>0.2 to 1.4</td>
<td>0.9 to 2.4</td>
<td>0.45 to 2.7</td>
<td>1.2 to 3.3</td>
<td>2.5 to 7.0</td>
<td>3.6 to 18.2</td>
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<tr>
<td>Compression hardness⁵ kPa</td>
<td>14</td>
<td>50</td>
<td>180</td>
<td>83</td>
<td>220</td>
<td>415</td>
<td>545</td>
<td>1650</td>
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<tr>
<td>Fire behaviour</td>
<td>B2, E</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

1 Measurement based on DIN EN ISO 1798
2 Measurement based on DIN 53513; load-, amplitude- and frequency-dependent
3 Measurement based on EN 826
4 Measurement based on DIN 53513; depending on frequency, load and thickness
5 Measurement based on DIN EN ISO 2286-2; compressive stress at 25% deformation, depending on thickness
6 Regupol® vibration 450 is used for vertical isolation.

Technical services and offers based on these are subject to our General Terms and Conditions of sale. In so far, please be advised as follows: Our expertise is the development and manufacturing of products. With our recommendation we can only assist you in selecting a product that is suitable for your demand. However, we cannot act as your architect or consulting expert. This would only be possible subject to a separately concluded service contract that we would have to bill you for. Such contracts are not part of our scope of supply and services. Hence, our recommendation does not lay claim for its correctness. Guarantees do only apply to the technical properties of the material supplied. All given values are approximate values.
**Regupol® Elastomer Mats**

**Material Composition**

Regupol® elastomers are composed of SBR and NBR rubber elements. For their production, rubber granulates, rubber fibres and rubber crumbs are combined with one another, processed and elasticised with various polyurethanes using a special manufacturing method.

Eight different Regupol® elastomers are available for the daily requirements. They can be used in a very wide load range if required.

The Regupol® elastomers offer a solution that is technically sufficient as well as the most economical one available for most vibration-technology-related jobs. Moreover, the BSW test lab offers the option of developing special, project- and application-specific types which can be given desired elastomer properties.

Regupol® elastomers can be distinguished from one another based on their individual load ranges and, accordingly, their dynamic rigidities.

**Effectiveness of the Regupol® Elastomers**

Regupol® elastomers can be specifically set for support frequencies between 20 Hz and 10 Hz in a broad load range from 0.050 N/mm² to 1.5 N/mm². Expert consultants in particular benefit from this large degree of flexibility.

The natural frequency progressions of the Regupol® elastomers are benign, offering expert consultants nearly constant natural frequencies across a wide load range. This makes for a large degree of security in planning and execution.

The creep (or creep behaviour) is low for all different Regupol® elastomers at approx. 5−7% of the total thickness. The admissible permanent load limits are kept, the only effect of overloading on the elastomers is increased rigidity (rise in dynamic rigidity and natural frequency), which shows in progressive deflection.

Regupol® elastomers are produced and shipped in rolls. They can be cut to size with a standard utility knife right at the construction site. The professional company at the construction site is thus ensured that the installation is going to be simple, quick and cost-efficient.

**Possible Uses**

Regupol® elastomers are suitable for all different kinds of vibration isolation.

Due to higher dynamic rigidities and the admissible load ranges of some elastomer types, buildings and machine foundations can either be bedded elastically on strips or on delicate point supports. Due to the low support frequencies, this type of support is technically efficient, but more difficult to plan and execute. The majority of isolation jobs are performed on full-surface Regupol® elastomers with lower rigidity, because this is more feasible and less error-prone.

The technical details, clearly arranged and determined as well as tested by the Technical University Dresden, provide a full overview of the load range of the Regupol® elastomers and their non-linear material properties. They allow expert consultants to select and properly size the elastomer type that suits the situation at hand and meets its respective requirements.

Additional benefits of Regupol® elastomers are their excellent moisture resistance, their rot-proof properties, their ozone resistance and their permanent elasticity even after frost-thaw cycles.

The use of Regupol® is therefore admissible not only inside but also outside of buildings. The only exception in this regard is Regupol® vibration 200. This material is to be protected against water penetration, as it has a low rigidity and a porous structure.
Product Overview

Regupol® sound is a compound material made of rubber fibres and polyurethane, and three versions of it were developed by BSW as heavy-duty impact sound insulation to be installed under a cement screed.

Regufoam® sound was also developed by BSW as an impact sound insulation sheet to be installed under a cement screed. The material has the highest impact sound reduction of all materials offered by BSW for this purpose. Regufoam® sound is a mixed-cell polyurethane foam.

<table>
<thead>
<tr>
<th>Material</th>
<th>Impact noise reduction</th>
<th>Maximum traffic load</th>
<th>Dynamic rigidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regupol® sound 47</td>
<td>$\Delta L_w \geq 20 \text{ dB}$</td>
<td>3,000 kg/m²</td>
<td>$s' = 47 \text{ MN/m}^3$</td>
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<tr>
<td>Regupol® sound 12</td>
<td>$\Delta L_w \geq 33 \text{ dB}$</td>
<td>3,000 kg/m²</td>
<td>$s' = 12 \text{ MN/m}^3$</td>
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<tr>
<td>Regupol® sound 17</td>
<td>$\Delta L_w \geq 26 \text{ dB}$</td>
<td>5,000 kg/m²</td>
<td>$s' = 17 \text{ MN/m}^3$</td>
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<tr>
<td>Regufoam® sound 10</td>
<td>$\Delta L_w \geq 34 \text{ dB}$</td>
<td>2,500 kg/m²</td>
<td>$s' = 10 \text{ MN/m}^3$</td>
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Detailed technical data and test documentation are available in the “Vibration Technology and Sound Insulation” technical catalogue, or at www.bsw-vibration-technology.com.

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Downloads at www.bsw-vibration-technology.com
Regupol® Screed Insulation in Brief

Many floor constructions have to withstand extreme loads while at the same time providing good sound insulation. BSW has developed Regupol® and Regufoam® screed insulation for these divergent objectives. Constant area loads of 25, 30 and 50 kN/m² are possible. Regupol® and Regufoam® screed insulation have a low compressibility in accordance with DIN EN 12431, i.e. $c \leq 1.0$ mm or $\leq 2.0$ mm. Moreover, the Regupol® and Regufoam® impact sound insulation mats return to nearly their original thickness.

Regupol® and Regufoam® have remarkable stability under great static and dynamic loads. Regupol® and Regufoam® are among the products with the best performance in the area of impact sound insulation under high loads, with great dimensional stability as well as durability.

The Benefits

- maximum traffic load of up to 2.5 and 5 t/m² respectively
- excellent ratio between impact sound improvement and structural height
- negligible creep behaviour, even under high static or dynamic continuous loads
- highly suitable for vibrated floor systems (no voids, etc.)
- suitable for high point loads
- unproblematic under rolling loads
- permanent elastic, rot-resistant
- high resilience level
- long service life
- quick and easy installation
- internal and external production and quality monitoring
- not harmful to health
- approved for any type of recreation room
- quality monitored by material testing agencies

Application Areas

Over the entire heavy-duty under-screed surface, e.g. in:

- Production halls, warehouses and dispatch stations
- Supermarkets in shopping centres
- Concert halls, auditoriums, cinemas, sound studios
- Gyms
- Hospitals, care homes
- Industrial kitchens and other floors frequently exposed to moisture
- Foyers of hotels and administrative buildings
- Libraries, universities, schools
- Workshops
- Test laboratories
- Under vibration floors

Made in Germany

- best quality
- fair pay
- secure jobs
- high environmental standards
Impact Noise Insulation under High Load

DIN 4109 defines the requirements for noise protection in building construction. In addition to protection against airborne noise, installation noise, noise of building service systems, noise of companies and external noise, it also provides guidelines for protection against impact noise. The standard therefore defines the minimum requirements for protecting people in common rooms from unacceptable interference.

DIN 4109 further regulates the method for proving the noise protection required. The specific noise protection level is currently not clearly regulated and must be agreed upon on a case-by-case basis. The values in the DIN 4109 Addendum 2 “Enhanced noise protection” may, for example, be used as reference values.

Addendum 2 of the standard recommends an impact noise level of at most 46 dB in the room to be protected as “enhanced noise protection”. Attempts to remain within these limit values show that quite a few noise protection measures are insufficient, particularly in rooms with a high floor load. Conventional, standard impact noise insulation materials must be very stiff to withstand high loads. Impact noise insulation therefore decreases with carrying capacity.

Effective impact noise insulation for such applications should therefore have two characteristics that may be in conflict with each other:

- high compressive strength to ensure lasting stability
- and at the same time high impact sound improvement coefficients

The progressive spring characteristics of Regupol® sound minimize the risk of tearing joints, as the material becomes stiff under high load.

The screed or the concrete base must be appropriately reinforced to counter these high loads, in particular in the rim and corner areas. Consistent technical data, verified by continuous in-house production control, are very important for the specialist planner, as they are the basis for dimensioning. BSW provides these data and guarantees them!

Floor constructions of rooms in which forklifts and lifting carts move are usually exposed to high static and dynamic loads. Only impact insulation mats which were specifically built to handle these loads can guarantee the necessary floor stability and sound insulation.

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Downloads at www.bsw-vibration-technology.com
Regupol® and Regufoam® Screed Insulation

The maximum compressibility of Regufoam® sound and Regupol® sound in accordance with general construction guidelines is between ≤ 1.0 and ≤ 2.0 mm, depending on the type.

With a load of 30 kN/m², the deflection of the insulating material Regupol® sound 47 is only 1.6 mm.

The loads on floor surfaces which have been impact-insulated with Regufoam® sound and Regupol® sound can be accordingly high without the danger of causing damage to the screed or connection joints which have the proper dimensions. Thanks to the outstanding long-term behaviour of the material, which was demonstrated by a long-term creep test with 12 million stress cycles, among other tests, its properties, such as resilience level and impact sound improvement, remained constant over a very long time period (approx. 50 years).

Resilience is at least 95%. The measured impact sound insulation values remain permanently constant.

The elastic behaviour of Regupol® and Regufoam® screed insulation demonstrates that the material retains its properties and is not damaged by high loads. These enormously important material properties can only be achieved with comprehensive quality assurance, from incoming goods inspection of the raw materials through to the impact sound improvement tests in the laboratory of the Testing and Certification Agency. For this reason it does not make sense and is even dangerous to use products that have not been specifically developed for impact sound insulation.

In addition to outstanding physical properties, Regupol® and Regufoam® screed insulation also possesses highly important chemical properties. The applications of industrial floors very frequently also require resistance to moisture and hydrolysis as well as resistance to lactic and fatty acids. What is more, resistance to the standard industrial and cleaning agents is an absolute must.

Even with a heavy load, Regupol® and Regufoam® screed installation sinks in without the structure of the material being destroyed (the deflection shown here is exaggerated).

When the load is removed, the material returns almost to its original thickness. The impact sound insulation remains constant for the long term.

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 Downloads at www.bsw-vibration-technology.com
Different Installations of Regupol® and Regufoam® Screed Insulation

The types of installations of screed insulation that are actually used most frequently are shown in the drawings below. Generally speaking, it has to be ensured that any acoustic bridges are avoided. If there is a conflict between heat insulation and impact sound damping, impact sound damping must be given preference for the sake of the immediate protection of people’s health.

a) Floating Screed:

b) Floating Screed with Underfloor Heating:

Standard installation of Regupol® and Regufoam® screed insulation; 1 perimeter insulation strip with PE foil • 2 floating screed • 3 Regupol® or Regufoam® screed insulation with PE foil on top • 4 concrete floor

Installation of Regupol® and Regufoam® screed insulation with underfloor heating; 1 perimeter insulation strip with PE foil • 2 floating screed • 3 underfloor heating pipe • 4 Regupol® or Regufoam® screed insulation with PE foil on top • 5 concrete floor

c) Black Screed with Heat Insulation and Pipe Feed-through:

d) Vibrated Clinker Layer:

Installation of Regupol® and Regufoam® under-screed impact sound insulation on heat insulation with pipelines: 1 perimeter insulation strip with PE foil • 2 floating screed • 3 Regupol® or Regufoam® screed insulation with PE foil on top • 4 heat insulation • 5 pipelines • 6 concrete floor

Installation of Regupol® and Regufoam® under-screed impact sound insulation under vibrated floors: 1 perimeter insulation strip with PE foil • 2 floor tiles with bonding agent • 3 floating screed • 4 Regupol® or Regufoam® screed insulation with PE foil on top • 5 concrete floor
Planning the Screed Insulation

During the planning of the construction project, a noise protection certificate is required in addition to a statics and heating certificate. Architects usually receive the assistance of expert consultants in this who can achieve the correct relationship between the sound properties of the different elements to one another.

The BSW specialist planning service is available to any architect who designs with Regupol® and Regufoam®.

The most important factors which must be included in the dimensioning of the screed insulation are:

- required noise protection
- necessary impact sound improvement
- static and dynamic loads to be borne

These basic parameters determine all other key values such as quality and thickness of the screed and the impact sound insulation to be applied.

Insulation of Adjacent Components

Generally speaking, in concrete construction, impact sound insulation that is incorporated into the building structure is only possible under floating screeds or the installment mortar of vibrated floors. Should other floor constructions be necessary such as bonded screed or screed on a separating layer, mandatory sound-insulating measures must be taken elsewhere. Feasible alternatives are the decoupling of individual parts of the building such as wall beddings and stair flights, under-floor impact sound insulation, entire room-in-room constructions or measures to reduce the airborne sound due to structure-borne noise in the reception room. As a general rule, however, the transfer of sound should be interrupted at the place where it is generated.

The following operation applies to the determination of the impact noise level to be expected in the room that must be protected:

\[ L'_{n,w} = L'_{n,w,eq} \cdot \Delta L_w \]

- \( L'_{n,w} \) = weighted standard impact noise level in the reception room (calculation value)
- \( L'_{n,w,eq} \) = equivalent weighted standard impact noise level of the solid floor without floor covering (calculation value)
- \( \Delta L_w \) = impact noise level reduction (calculation value)

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Downloads at www.bsw-vibration-technology.com
Planning the Screed Insulation

When planning the screed insulation, the planner must be able to rely on the technical data supplied by the manufacturer of the impact sound insulation layer. It must therefore be checked carefully whether the specifications are feasible and whether they adhere to the applicable standards. If there are any doubts about the specifications, a test certificate should be produced on request (concerning the applicability of impact sound tests and their adherence to standards, see page 26). BSW states reliable and verifiable values as per ISO 140-8.

In actuality, even these test results only provide a benchmark, as they are based on a standardised test set-up. In real life, however, thickness and material consistency of the concrete floor and screed often deviate from them. How this impacts the impact noise level that can actually be achieved depends on the calculation performed by the expert consultant / acoustic engineer.

An essential key value for installing screed insulation is the dynamic rigidity of the impact sound insulation layer.

As a rule, the following applies to conventional, standardised insulation materials:

<table>
<thead>
<tr>
<th>Dynamic rigidity</th>
<th>Sound insulation</th>
<th>Load-bearing capacity</th>
<th>Compression</th>
</tr>
</thead>
<tbody>
<tr>
<td>high</td>
<td>low</td>
<td>high</td>
<td>low</td>
</tr>
<tr>
<td>low</td>
<td>high</td>
<td>low</td>
<td>high</td>
</tr>
</tbody>
</table>

By contrast, the screed insulation materials Regufoam® sound and Regupol® sound can withstand high loads and insulate impact sound very well, which distinguishes them enormously from conventional insulation materials. With a maximum traffic load of 3,000 kg/m², for instance, a maximum impact noise level reduction of 33 dB can be achieved with Regupol® sound 12.

Random layers of materials which may be similar in their physical appearance but are made of bonded rubber granulate, can cause tremendous problems regarding the required load-bearing capacity of the floor construction, as their physical behaviour may be utterly unsuitable. Impact sound insulation materials must be standardised or approved. When alternative products are used which look the same on the outside, it is doubtful if they can achieve equally good impact sound insulation.

The following sample calculation as per DIN 4109 for Regupol® sound 17 already contains the required values of the screed and the concrete floor.

20 cm reinforced concrete floor
\[ L'_{n,w,eq} = 71 \text{ dB} \]

- 17 mm screed insulation mat Regupol® sound 17 under 90 mm screed plus tiles or under 120 mm screed / reinforced concrete base plate
\[ \Delta L_w = 24 \text{ dB} \]
\[ + 2 \text{ dB} \]
\[ - L'_{n,w} = 49 \text{ dB} \]

With this impact sound insulation and proper dimensioning, the total construction would be able to bear loads of up to 5,000 kg/m². The different concrete floors have different initial sound technology values.

Here is an example:

<table>
<thead>
<tr>
<th>Reinforced concrete</th>
<th>Mass kg/m²</th>
<th>Equivalent weighted standard impact noise level [ L'_{n,w,eq} ]</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>391</td>
<td>74</td>
</tr>
<tr>
<td>18</td>
<td>414</td>
<td>73</td>
</tr>
<tr>
<td>19</td>
<td>437</td>
<td>72</td>
</tr>
<tr>
<td>20</td>
<td>460</td>
<td>71</td>
</tr>
<tr>
<td>21</td>
<td>483</td>
<td>70</td>
</tr>
<tr>
<td>22</td>
<td>506</td>
<td>69</td>
</tr>
<tr>
<td>etc.</td>
<td>etc.</td>
<td>etc.</td>
</tr>
</tbody>
</table>

Taking Sources of Error into Account

When planning the sound technology of a floor construction, numerous sources of errors must be taken into account. These are mainly various acoustic bridges, typically other construction elements which transfer the sound without insulation to other areas of the building by avoiding or interrupting the impact sound insulation. They may considerably impair the effect of an impact sound insulation measure.

As a rule, the following applies:

The impact sound insulation must be complete. Even minute structural parts such as connection and fastening elements, but especially pipelines and constructions made of concrete or other materials which are on top or adjacent, must be excluded as transmitters of impact sound.
Planning the Screed Insulation

The most frequent mistake in the planning and installation of screed insulation is the lack of or insufficient consideration of pipelines. Pipelines are often directly on top of the concrete floor and can form acoustic bridges unless they are decoupled from the sound-emitting room.

DIN 18560-2 specifies two versions of pipelines under floating screeds and on load-bearing subfloors:

- levelling screed or another levelling layer in bonded form
- screed pipe height compensation with heat insulation boards

for achieving a level surface that can receive the insulating layer of the impact sound insulation. The pipes which are on the load-bearing concrete floor must be fixed. The construction height of the levelling layer must be determined in the plan.

Other sources of flaws are:

- stairways and landing platforms which are connected with the sound-transmitting surface must be decoupled from it
- radiator supports
- built-in components anchored in the screed and the wall
- pipelines which are fed into the walls
- joint dowels to interrupt horizontal sound waves
- support columns and partition walls

The reason is that testing according to category I is conducted on an area of, say, merely 1 x 0.4 m and is admissible for compliant covering which was installed loose or sticking to the floor covering, but not for screed insulation mats in floor coverings where at least one component is solid (e.g. screed) as described in category II.

Only testing as per DIN EN ISO 140-8, testing category II, determines practice-oriented dB values for screed insulation.

How much the impact sound insulation values of a test according to category I can deviate from those of the practice-oriented tests for screed insulation mats is demonstrated in the following example with Regupol® screed insulation.

In the benchmark test for Regupol® screed insulation as per testing category I, a sound reduction value was achieved of

$$\Delta L_w = 33 \text{ dB}.$$  

The practice-oriented test in category II, on the other hand, showed a sound reduction value of

$$\Delta L_w = 20 \text{ dB}.$$  

For this reason attention must be paid to the testing category when assessing the indicated impact noise reduction values. If necessary, you should request to see the test certificate.

Checking the Technical Specifications for Impact Sound Insulation Mats

A proper check of the impact noise reduction for screed insulation mats is therefore testing category II as per EN ISO 140-8. Accordingly, the tested area is at least 10 m² in size. The values measured in this test form the basis of the calculation value for impact noise reduction with screed insulation mats. It is considerably lower than the dB values measured according to testing category I.
Impact Sound Insulation Under Screed

Largely rot-, moisture-, age- and deformation-resistant, permanently elastic

Material
PU-bonded rubber fibres

Standard delivery form
in rolls of 15 m² each, 13,040 x 1,150 x 8 mm

Temperature resistance
from –20 °C to +80 °C

Colour
Anthracite

Physical Data

<table>
<thead>
<tr>
<th>Weighted impact noise reduction as per ISO 717-2</th>
<th>( \Delta L_w \geq 20 \text{ dB} )</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Mean value for dynamic rigidity as per DIN EN 29052-1</th>
<th>( s' = 47 \text{ MN/m}^2 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thermal conductivity</td>
<td>( \lambda = 0.075 \text{ W/mK} )</td>
</tr>
<tr>
<td>Thermal resistance</td>
<td>( R = 0.1031 \text{ m²K/W} )</td>
</tr>
</tbody>
</table>

Fire classification according to DIN 4102/DIN EN 13501-1
B2 / Class E

Maximum traffic load
up to 3,000 kg/m²

Compressibility as per DIN EN 12431
\( c \leq 1.0 \text{ mm} \)

<table>
<thead>
<tr>
<th>Compressive stress (N/mm²)</th>
<th>Settlement (mm)</th>
<th>Bedding modulus (MN/mm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0015</td>
<td>0</td>
<td>12.0</td>
</tr>
<tr>
<td>0.0059</td>
<td>0.476</td>
<td>14.0</td>
</tr>
<tr>
<td>0.0118</td>
<td>0.863</td>
<td>16.0</td>
</tr>
<tr>
<td>0.0206</td>
<td>1.284</td>
<td>18.0</td>
</tr>
<tr>
<td>0.0294</td>
<td>1.605</td>
<td>11.0</td>
</tr>
<tr>
<td>0.0118</td>
<td>1.066</td>
<td></td>
</tr>
</tbody>
</table>

Performance and evaluation of test as per DIN 18134, sample measurements and testing facility as per DIN EN 826. Tested by Technical University Dresden.

Regupol® sound 47, dimpled on underside
Impact Noise Reduction Regupol® sound 47 as per ISO 140-8

Measurement of the impact noise reduction, provided by a floor covering on a solid standard floor under test conditions

Description of the test object

- 68 mm concrete screed
- 0.20 mm PE foil
- 8 mm screed insulation mat, Regupol® sound 47 (dimpled on one side)
- mean value of dynamic rigidity as per DIN EN 29052-1, £ = 47 MN/m³
- 8 mm perimeter screed strip (foamed PE foil)
- 140 mm raw ceiling

Basis weight approx. 135 kg/m²
Setting time 552 h
Air temperature in the test rooms 21 °C
Humidity in the test rooms 56 %
Volume of reception room 54.2 m³

Impact noise reduction improvement as per ISO 717-2

$\Delta L_{\text{w}} \geq 20 \text{ dB} \quad C_{1,\alpha} = -12 \text{ dB} \quad C_{1,\text{r}} = 1 \text{ dB}$

The results refer only to the tested structure.

Test for obtaining the national technical approval

on 05.12.2005
MPA NRW
44285 Dortmund
Germany
Phone +49 (0)231 45020
Fax +49 (0)231 458 549

We will be pleased to send you the complete test report no. 420001705 upon request.
Impact Sound Insulation Under Screed

Largely rot-, moisture-, age- and deformation-resistant, permanently elastic

**Material**
PU-bonded rubber fibres

**Standard delivery form**
1,200 x 1,000 x 17 mm, 60 m² per pallet

**Temperature resistance**
from –20 °C to +80 °C

**Colour**
Anthracite

Upper side laminated with green aluminium foil.

**Physical Data**

<table>
<thead>
<tr>
<th>Compressive stress (N/mm²)</th>
<th>Settlement (mm)</th>
<th>Bedding modulus (N/mm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0025</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.0098</td>
<td>1.4</td>
<td>7.0</td>
</tr>
<tr>
<td>0.0196</td>
<td>2.6</td>
<td>8.0</td>
</tr>
<tr>
<td>0.0343</td>
<td>3.9</td>
<td>9.0</td>
</tr>
<tr>
<td>0.0490</td>
<td>4.7</td>
<td>10.0</td>
</tr>
<tr>
<td>0.0196</td>
<td>3.2</td>
<td>6.0</td>
</tr>
</tbody>
</table>

Mean value for dynamic rigidity as per DIN EN 29052-1
s' ≈ 17 MN/m²

**Thermal conductivity**
λ = 0.08 W/mK

**Thermal resistance**
R = 0.2162 m²K/W

**Fire classification according to DIN 4102/DIN EN 13501-1**
B2 / Class E

**Maximum traffic load**
up to 5,000 kg/m²

**Compressibility as per DIN EN 12431**
c ≤ 2.0 mm

---

Performance and evaluation of test as per DIN 18134,
sample measurements and testing facility as per DIN EN 826.
Tested by Technical University Dresden.
Impact Noise Reduction Regupol® sound 17 as per ISO 140-8

Measurement of the impact noise reduction, provided by a floor covering on a solid standard floor under test conditions

Description of the test object

- 28 mm cast stone
- approx. 4 mm thin-set mortar
- approx. 90 mm screed
- 0.25 mm PE foil
- 17 mm screed insulation mat, Regupol® sound 17, single layer
- mean value of dynamic rigidity as per DIN EN 29052-1, \( s' = 17 \text{ MN/m}^2 \)
- length-related flow resistance as per EN 29053:
  - \( r = 8088 \text{ Pa s/m}^2 \)
- 150 mm reinforced concrete
- perimeter strip made of mineral fibreboards, 15 mm thick
- mass per unit area of the floor covering 240 kg/m²

Mass per unit area: 600 kg/m²
Test surface area: 16.9 m²
Test rooms – volume of reception room: \( V_e = 51.3 \text{ m}^3 \)
Condition: empty
Type: laboratory

Impact noise reduction improvement as per ISO 717-2

\[ \Delta L_{\text{w}} \geq 26 \text{ dB} \quad C_{I_{\text{ax}}} = -13 \text{ dB} \quad \Delta L_{\text{lin}} = 13 \text{ dB} \]

The results refer only to the tested structure.

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>( L_{\text{raw ceiling}} ) ( \frac{1}{3} \text{ octave} ) dB</th>
<th>( \Delta L ) ( \frac{1}{3} \text{ octave} ) dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>57.5</td>
<td>2.2</td>
</tr>
<tr>
<td>125</td>
<td>60.3</td>
<td>2.1</td>
</tr>
<tr>
<td>160</td>
<td>60.7</td>
<td>10.1</td>
</tr>
<tr>
<td>200</td>
<td>61.6</td>
<td>9.1</td>
</tr>
<tr>
<td>250</td>
<td>61.5</td>
<td>14.6</td>
</tr>
<tr>
<td>315</td>
<td>63.8</td>
<td>17.1</td>
</tr>
<tr>
<td>400</td>
<td>62.1</td>
<td>18.8</td>
</tr>
<tr>
<td>500</td>
<td>63.3</td>
<td>23.8</td>
</tr>
<tr>
<td>630</td>
<td>63.3</td>
<td>25.9</td>
</tr>
<tr>
<td>800</td>
<td>64.4</td>
<td>28.9</td>
</tr>
<tr>
<td>1,000</td>
<td>65.6</td>
<td>29.8</td>
</tr>
<tr>
<td>1,250</td>
<td>66.4</td>
<td>34.2</td>
</tr>
<tr>
<td>1,600</td>
<td>66.7</td>
<td>39.5</td>
</tr>
<tr>
<td>2,000</td>
<td>66.7</td>
<td>47.1</td>
</tr>
<tr>
<td>2,500</td>
<td>66.6</td>
<td>51.9</td>
</tr>
<tr>
<td>3,150</td>
<td>67.2</td>
<td>56.0</td>
</tr>
</tbody>
</table>

Qualification test I for DIN 4109 on 05.05.1999

Publication of the results is authorised by the Ingenieurgesellschaft für Technische Akustik mbH
Max-Planck-Ring 49
65205 Wiesbaden
Germany
Phone +49 (0)6122 956 10
Fax +49 (0)6122 956 161

We will be pleased to send you the complete test report no. 0070.99-P 57 upon request.
Impact Sound Insulation Under Screed

Largely rot-, moisture-, age- and deformation-resistant, permanently elastic, but protect against large volumes of water.

**Material**
PU-bonded elastomers

**Standard delivery form**
1,200 x 1,000 x 17 mm, 60 m² per pallet

**Temperature resistance**
from −20 °C to +80 °C

**Colour**
brown-beige, dark particles

Upper side laminated with green aluminium foil.

**Physical Data**

| Weighted impact noise reduction as per ISO 717-2 | \( \Delta L_w \geq 33 \text{ dB} \) |

| Mean value for dynamic rigidity as per DIN EN 29052-1 | \( s' \approx 12 \text{ MN/m}^3 \) |

| Thermal conductivity | \( \lambda = 0.0063 \text{ W/mK} \) |

| Thermal resistance | \( R = 0.289 \text{ m²K/W} \) |

**Fire classification according to DIN 4102/DIN EN 13501-1**
B 2 / Class E

**Maximum traffic load**
up to 3,000 kg/m²

**Compressibility as per DIN EN 12431**
\( c \leq 2.0 \text{ mm} \)

**Compressive stress (N/mm²)** | **Settlement (mm)** | **Bedding modulus (MN/mm³)**

| 0.005 | 2.1 | 2.8 |
| 0.010 | 3.2 | 3.1 |
| 0.020 | 4.5 | 4.5 |
| 0.025 | 4.9 | 5.1 |
| 0.030 | 5.3 | 5.7 |
| 0.020 | 4.7 | 4.3 |

Performance and evaluation of test as per DIN 18134, sample measurements and testing facility as per DIN EN 826.
Impact Noise Reduction Regupol® sound 12 as per ISO 10140-3

Measurement of the impact noise reduction, provided by a floor covering on a solid standard floor under test conditions

Description of the test object

- 160 mm raw ceiling
- 17 mm Regupol® sound 12 screed insulation mat
- 0.25 mm PE-foil
- 80 mm screed
- total thickness 255 mm
- mean value of dynamic rigidity as per DIN EN 29052-1, $s' = 12$ MN/m³

Mass per unit area: 581.6 kg/m²
Test surface area: $4.0 \times 5.0 = 20.0$ m²
Volume of test rooms: $V_g = 54$ m³, $V_E = 62$ m³
Air temperature in test rooms: 21 °C
Water curing: > 21 days

Impact noise reduction improvement as per ISO 717-2

$\Delta L_{w,\alpha} \geq 33$ dB $C_{w,\alpha} = -12$ dB

The results refer only to the tested structure.

<table>
<thead>
<tr>
<th>Frequency (Hz)</th>
<th>$L_{raw,\frac{1}{3} octave}$ dB</th>
<th>$\Delta L_{\frac{1}{3} octave}$ dB</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>66.1</td>
<td>11.7</td>
</tr>
<tr>
<td>125</td>
<td>62.8</td>
<td>11.5</td>
</tr>
<tr>
<td>160</td>
<td>68.1</td>
<td>15.3</td>
</tr>
<tr>
<td>200</td>
<td>69.0</td>
<td>18.5</td>
</tr>
<tr>
<td>250</td>
<td>70.0</td>
<td>23.3</td>
</tr>
<tr>
<td>315</td>
<td>71.4</td>
<td>27.0</td>
</tr>
<tr>
<td>400</td>
<td>70.4</td>
<td>29.0</td>
</tr>
<tr>
<td>500</td>
<td>71.4</td>
<td>31.6</td>
</tr>
<tr>
<td>630</td>
<td>71.2</td>
<td>34.6</td>
</tr>
<tr>
<td>800</td>
<td>72.4</td>
<td>39.0</td>
</tr>
<tr>
<td>1000</td>
<td>72.0</td>
<td>42.3</td>
</tr>
<tr>
<td>1250</td>
<td>72.6</td>
<td>46.9</td>
</tr>
<tr>
<td>1600</td>
<td>72.9</td>
<td>50.5</td>
</tr>
<tr>
<td>2000</td>
<td>72.0</td>
<td>54.8</td>
</tr>
<tr>
<td>2500</td>
<td>71.6</td>
<td>58.7</td>
</tr>
<tr>
<td>3150</td>
<td>70.9</td>
<td>63.0</td>
</tr>
</tbody>
</table>
Impact Sound Insulation Under Screed

Largely rot-, moisture-, age- and deformation-resistant, permanently elastic, but protect against large volumes of water.

**Material**
Mixed-cell polyurethane foam

**Standard delivery form**
1,500 x 1,100 x 17 mm, 198 m² per pallet

**Temperature resistance**
from –20 °C to +80 °C

**Colour**
light blue

**Physical Data**

<table>
<thead>
<tr>
<th>Compressive stress (N/mm²)</th>
<th>Settlement (mm)</th>
<th>Bedding modulus (MN/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.005</td>
<td>3.4</td>
<td>1.5</td>
</tr>
<tr>
<td>0.010</td>
<td>4.9</td>
<td>2.1</td>
</tr>
<tr>
<td>0.015</td>
<td>5.9</td>
<td>2.5</td>
</tr>
<tr>
<td>0.020</td>
<td>7.0</td>
<td>2.8</td>
</tr>
<tr>
<td>0.025</td>
<td>8.1</td>
<td>3.1</td>
</tr>
<tr>
<td>0.015</td>
<td>6.2</td>
<td>2.4</td>
</tr>
</tbody>
</table>

Mean value for dynamic rigidity as per DIN EN 29052-1
$s' = 10 \text{ MN/m}^3$

**Thermal conductivity**
$\lambda = 0.046 \text{ W/mK}$

**Thermal resistance**
$R = 0.331 \text{ m}^2\text{K/W}$

Fire classification according to DIN 4102/DIN EN 13501-1
B 2 / Class E

**Maximum traffic load**
up to 2,500 kg/m²

**Compressibility as per DIN EN 12431**
$c \leq 2.0 \text{ mm}, \text{ deformation-resistant, compressible volume}$
Impact Noise Reduction Regufoam® sound 10 as per ISO 10140-3

Measurement of the impact noise reduction, provided by a floor covering on a solid standard floor under test conditions

Description of the test object

- 160 mm raw ceiling
- 17 mm Regufoam® sound 10 screed insulation mat
- 0.25 mm PE-foil
- 80 mm screed

- total thickness 257 mm
- mean value of dynamic rigidity as per DIN EN 29052-1, $s' = 10 \text{ MN/m}^3$

Mass per unit area: 581.6 kg/m$^2$
Test surface area $S$: $4.0 \times 5.0 = 20.0 \text{ m}^2$
Volume of test rooms: $V_S = 54 \text{ m}^3$, $V_E = 62 \text{ m}^3$
Air temperature in test rooms: 21 °C
Water curing: > 21 days

Impact noise reduction improvement as per ISO 717-2

$\Delta L_{w} \geq 34 \text{ dB}$  
$C_{\lambda} = -13 \text{ dB}$

The results refer only to the tested structure.

Qualification test for DIN 4109 on 01.08.2012

Publication of the results is authorised by ift Rosenheim GmbH
Theodor-Gietl-Str. 7-9
83026 Rosenheim
Germany
Phone +49 (0)8031 261-0
Fax +49 (0)8031 261-290

We will be pleased to send you the complete test report no. 12-001691-PR01 (PBX3.1-F03-04-de-01) upon request.
Installation Guidelines

Concrete Floor

Before the Regupol® and Regufoam® screed insulation is installed, make sure the concrete floor is swept clean and dry. Protruding pieces, stones and chunks of concrete must be removed. Any slight unevenness may be ignored, as it will be levelled by Regupol® and Regufoam® screed insulation.

Perimeter Insulation

Prior to the installation of the Regupol® and Regufoam® Perimeter Insulation Strips, Regupol® and Regufoam® Perimeter Insulation Strips must be installed in all adjoining vertical structural elements such as walls, columns, pipes, etc. Their width equals approximately the entire structural height of the floor construction from the top edge of the concrete floor including the floor covering with possible additional impact sound insulation.

Unrolling the Screed Insulation Mats

The Regupol® and Regufoam® Screed Insulation Mats are unrolled parallel to one another, butt to butt, on the concrete floor with the dimpled side down.

Coil tension may cause the material to shrink slightly in the direction in which it was rolled. We therefore recommend that you pull up the insulation mat a few centimetres lengthwise in front of the perimeter insulation strip. After a few hours the roll can be cut to the exact required length.

The material is butt-joined and taped down on the top side with a suitable adhesive tape in order to avoid acoustic bridges.
Installation Guidelines

Covering with PE Foil

Once the Regupol® and Regufoam® Screed Insulation Mats have been installed and cut to the required length, they are covered with PE foil which has a minimum thickness of 0.2 mm, and the perimeter insulation strips are pulled up on the outer sides. The butts and overlaps of the foil strips are taped together with a suitable adhesive tape. The foil should cover the entire screed insulation in order to avoid acoustic bridges.
References

These references constitute only a small selection of all buildings which have been equipped with Regupol® under-screed impact sound insulation.

**ADAC Headquarters**
Place: Munich, Germany
Screed insulation with Regupol® BA
Insulated building part: print shop

**Elbphilharmonie**
Place: Hamburg, Germany
Screed insulation with Regupol® BA, Regupol® E48
Insulated building part: concert halls and studios

**Cinemagnum**
Place: Nuremberg, Germany
Screed insulation with Regupol® BA
Insulated building part: underground car park

Other buildings insulated with Regupol® are:

**RTL Studios**, Cologne, Germany

**Hesse State Parliament**, Wiesbaden, Germany

**Frankfurt Airport**, Frankfurt, Germany

**Nuremberg Trade Fair Centre**, Nuremberg, Germany

**Scandic Hotel**, Berlin, Germany

**University Clinic**, Regensburg, Germany

**Clinical Centre**, Minden, Germany

**Deutsche Bank Building**, Frankfurt, Germany

**Commercial Park Laim**, Munich, Germany

**Commerzbank Tower**, Frankfurt, Germany

**Musiktheater**, Linz, Austria
References

These references constitute only a small selection of all buildings which have been equipped with Regupol® under-screed impact sound insulation.

The Shard
Place: London, United Kingdom
Screed insulation with Regupol® E48
Insulated building part: 42 floors of Shangri-La Hotel

Central Bus Terminal
Place: Munich, Germany
Screed insulation with Regupol® E48
Insulated building part: floor plates in the service and trade areas

Audi plant
Place: Gyor, Hungary
Screed insulation with Regupol® BA
Insulated building part: plant

Other buildings insulated with Regupol® are:

Opera House, Frankfurt, Germany
Doha Exhibition and Convention Centre, Doha, Qatar
One Hyde Park, London, United Kingdom
DFS Deutsche Flugsicherung GmbH, Langen, Germany
Wisseloord Studios, Hilversum, Netherlands
Vibration Isolation of Machine Foundations

Active and Passive Isolation
Vibration Isolation of Machine Foundations

Unwanted vibrations and shock impact occur in nearly all technical equipment and machinery — but elastic bedding with the well-known materials Regupol® and Regufoam® reliably prevent the distribution of these vibration forces.

BSW has produced, sized and supplied material for the vibration isolation of machine foundations for over 20 years.

The material Regupol® is composed of rubber fibres, rubber granulates (SBR, NBR) and polyurethanes, and Regufoam® is a mixed-cell polyurethane foam.

Probably the most important measure for reducing the vibration impact of machinery in a building structure and its surroundings is the elastic decoupling of the machine foundations.

We distinguish between “active” and “passive” vibration isolation. In active isolation the spread of vibrations is reduced, and in passive isolation sensitive equipment is protected against ambient vibrations.

Generally speaking, active isolation of the source is the preferred solution, as this measure can protect larger impact areas and thus several objects.

Regupol® and Regufoam® are subdivided into 8 or 12 load ranges each. As a consequence, they can cover a broad spectrum of vibration-technology-related applications. Thanks to the rigidities of the selected materials, the settlement behaviour is the same for nearly all types.

This provides the expert consultants for vibration technology issues with two product groups that are helpful to them in developing the most economical and technically best solution possible.

Detailed technical data, including delivery formats, static and dynamic constants, long-term behaviour and further material constants are provided in the “Vibration Technology and Sound Insulation” technical catalogue or at www.bsw-vibration-technology.com

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Downloads at www.bsw-vibration-technology.com
The Single-Degree-of-Freedom System

The easiest example to describe a vibrating system is a single-degree-of-freedom system (SDOF system). An inert mass is on a rigid base, separated by an elastic element.

The machine (= mass) is decoupled from its ambient area by way of a spring and a damper. Only one degree of freedom is applied and usually only the vertical movement is considered.

The special elastomers Regupol® and Regufoam® simultaneously serve as spring and damper.

The model is quite useful in explaining basic issues of vibration isolation and is helpful in selecting suitable elastomers.

The model can be applied to active as well as passive isolation jobs. A distinction is made between the time-dependent force and the kinematic excitation (auxiliary excitation) of the vibrator.

![Image of a single-degree-of-freedom system]

Equation of motion of the force-excited vibrator

\[ m\ddot{x} + b\dot{x} + cx = F(t) \]

Equation of motion of the auxiliary-excited vibrator

\[ m\ddot{x} + b(\dot{x} - \dot{s}) + c(x - s) = 0 \]

F(t) is the time-dependent force excitation and s(t) the time-dependent kinematic excitation / auxiliary excitation. The coordinate \( x \) describes the movement of the vibrator, whose parameters mass, damping and rigidity are designated as \( m \), \( b \) and \( c \).
The Natural Frequency

If a vibration-capable system is made to vibrate and then left to its own devices, it vibrates with the so-called natural frequency until it dies away.

In machine foundation isolation, the natural frequencies of this system can be deliberately influenced by varying its rigidity and inertial properties.

The natural frequency is calculated as follows:

\[ f_0 = \frac{1}{2\pi} \sqrt{\frac{s}{m}} \]

\( s \) – dynamic rigidity; \( m \) – vibrating mass

The inertial properties depend on the geometry and the mass ratios of the machine and the intermediate foundation.

The rigidity properties can be set to a desired level with the Regupol® and Regufoam® elastomers. To achieve lower bearing frequencies in one load range, the thickness of the elastomer must be increased.

It is a fact that the frequency progressions of different types of Regupol® and Regufoam® are similar in the respective load range. The reasons are mainly as follows:

Achieving high load-bearing capacities requires minimum rigidities of the elastomer. Considering the greater mass and the load-bearing capacity that is therefore required (and hence also the greater rigidity), the above formula shows that similar bearing frequencies can be achieved again.

Thus lower bearing frequencies can be achieved by increasing the dynamic mass and by reducing the rigidity of the elastomer.

Damping in the Elastomer

When energy is withdrawn from sound we speak of damping. This typically occurs through dissipation, by transforming the sound energy into heat by way of friction.

In the case of elastomers we observe the mechanical damping \( \eta \) (loss factor). The loss factor is a measurement for the speed with which the amplitudes of free vibrations die away.

The higher the damping, the lower the resonance. At the same time, a very high degree of damping results in worse insulation capabilities in the material with respect to interfering frequencies with a ratio of \( > \sqrt{2} \) to the natural frequency.

The chart shows the reduction of a vibration amplitude as a result of mechanical damping. It is defined by the mechanical loss factor \( \eta \). The time of vibration \( T \) remains the same.
Airborne Sound Insulation / Structure-Borne Sound Insulation

When it comes to machines, considering the airborne insulation often does not suffice. This is illustrated by the following example:

The music box in the illustration at the top represents our machine. When the clock mechanism is wound up, the barrel begins to turn, and the 18 pins generate a soft melody.

Due to the small geometric dimensions of the device, only a few of the oscillations are transformed into airborne sound.

The melody only becomes louder when the vibration-distributing surface is enlarged. This happens as soon as the music box is placed on a table top. The vibrations from the music box are now transmitted to the table top. This part is called structure-borne sound.

Imagine that this machine is placed inside your business, causing unacceptable noise. Often the first measure to be suggested is a sound protection hood, which usually, however, has no effect whatsoever.

The reason for this is the big difference between the soft “airborne sound” and the loud “structure-borne sound”. It makes it necessary to take primary measures that reduce the loud structure-borne sound.

Elastic bedding with Regupol® and Regufoam®, adjusted to the machine in question, reduces the generation of the structure-borne sound.

Placing in addition a sound protection hood over the machine removes the noise problem.

If you have any further questions about this issue or wish to communicate with an expert consultant, please feel free to get in touch with us at any time.

Only an elastic bedding reduces effectively the structure-borne sound.
Insertion Loss / Isolation Efficiency

The success of an elastic solution can be described using the example of insertion loss or the isolation efficiency factor. Insertion loss describes the difference between the application of force in the ambient area using “rigid” and “elastic” bedding.

The isolation effect depends on the ratio between the natural frequency $\omega_0$ and the interfering frequency $\omega$. The natural frequency should be below the lowest interfering frequency (low adjustment). The softer the elastomer and thus the lower the natural frequency, the better the isolation effect.

The chart below shows the isolation efficiency and the insertion damping for Regupol® vibration 200. All documentation about the material reference values may be found in our technical brochure on vibration insulation.

<table>
<thead>
<tr>
<th>Regupol® vibration 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural frequency in Hz</td>
</tr>
<tr>
<td>4  8  12  16  20  24  28  32  36  40</td>
</tr>
<tr>
<td>Interfering frequency in Hz</td>
</tr>
</tbody>
</table>

Sample calculation of insertion damping of $f_0 = 14$ Hz for a single-degree-of-freedom system on a rigid substrate.

The isolation effect furthermore depends on the mechanical damping (loss factor) of the elastomers. For this reason, having precise material constants are absolutely necessary for the vibration-related measurements.

The material constants for Regupol® and Regufoam® were determined at the Technical University in Dresden, among other institutions, and are subjected to permanent quality control.
Dimensioning Machine Foundation Isolation

Dimensioning vibration-isolating measures is the duty of the expert consultant. He or she is the only person who can judge the complex overall building dynamics. When planning elastic machine foundation isolation, special care must be taken that component resonances are avoided. Attention should also be paid to the place where equipment is installed.

The simplified view of regarding the machine as a single-degree-of-freedom system is based on an ideal, rigid placement of the elastomer. When excitation masses are not very small compared to the mass of the foundation, it might be necessary to consider the foundation impedance.

For isolation to be effective, the following important planning parameters must be taken into account:

1. For machines with harmonious excitation, such as building equipment, the isolation effect is determined by the ratio of the interfering frequency $\omega$ and the natural frequency of the elastic bedding (natural frequency) $\omega_0$.

2. The degree of the isolation effect depends on the damping behaviour of the elastomer.

3. Polyurethane foams and composite products made of rubber fibres, rubber granulates (SBR, NBR) and polyurethanes exhibit pronounced non-linear material behaviour. Consequently, it is necessary to perform precise material tests.

Typically an attempt is made to generate supercritical bedding for the machine. This means that the natural frequency $\omega_0$ is smaller than the interfering frequency $\omega$. To achieve a physical damping effect, it is absolutely necessary that the ratio is at least $\sqrt{2}$. In point of fact, the ratio should be at least 2 to 3. The higher the selected ratio, the higher the isolation effect to be achieved.

Ideally, planning measures for the vibration isolation of machines with Regupol® or Regufoam® is conducted according to the following pattern:

1. Calculation of the characteristic compression (without partial load factors) under the machine foundation from the dead weight of the foundation block and the dead weight of the machine.

2. Selection of the suitable Regupol® or Regufoam® type taking the maximum static permanent load into account.

3. Considering the crucial interfering frequencies of the machine (in the case of active isolation) or consideration of the crucial interfering frequencies of the ambient area (in the case of passive isolation).

4. Selection of the natural frequency taking the insertion loss / isolation effect that can be achieved and the ratio to the interfering frequency into account. An absolute requirement: a ratio between natural frequency and interfering frequency of $>\sqrt{2}$.

5. Installation of the floating machine foundation taking points 1–4 into account.

Recommendation and coordination of specialist planners for building acoustics.

Find out more on Page 61 onwards.
Machine Foundation Isolation Regupol® vibration

Step 1:
Installing the Regupol® vibration isolation

Step 2:
Exact cut to the dimensions of the foundation

Step 3:
Setting up the formwork for the machine foundation

Step 4:
Putting in a PE foil with a minimum thickness of 0.2 mm
Step 5:
Filling with concrete

Step 7:
Backfilling the remaining space with concrete and smoothing everything at the end

Step 6:
Putting in the foundation reinforcement

Step 8:
Allow to harden, then remove the formwork
Vibration Isolation of Buildings

Resilient Bedding of Buildings
Vibration Isolation of Building Foundations

Various factors may subject buildings to shock which continues in their structure and is perceived by the people living in them as noticeable vibrations or secondary airborne noise. Specifically in areas with a dense infrastructure, these are typically vibration emissions from above- or underground railway lines and from industrial plants.

Especially the high prices of land in conurbations also make locations next to railway lines attractive if the buildings there are sufficiently isolated against the attendant vibrations. The price advantage of acquiring land that is exposed to vibrations of this kind far exceeds the additional expenditures for the resilient bedding of buildings. The materials made of Regupol® and Regufoam® have been developed to isolate vibrations. Numerous building foundations have already been successfully isolated against vibration impact with Regupol® and Regufoam®.

With Regupol® and Regufoam®, BSW offers a total of 20 different materials.

Vibration remeasurements in already completed projects have shown that vibration isolation with these materials was sometimes able to achieve better results than the required minimum value determined in the forecast.

The material Regupol® is composed of rubber fibres, rubber granulates (SBR, NBR) and polyurethanes, and Regufoam® is a mixed-cell polyurethane foam.

All the physical properties of the vibration-isolating products of BSW which the expert consultants require are sufficiently documented. Thanks to their different load ranges, various types of material can be used for different areas bearing different loads. Consequently, even demanding isolation jobs can be mastered.

The vibration isolation of buildings that is achieved with Regupol® and Regufoam® remains at a constantly high level for the long term. It has been possible to document the isolating effect of structures through control measurements after their completion and after ten years of use.

In cooperation with the expert consultants, BSW has also developed specifically designed types or modifications of material for particularly demanding projects.

Regupol® and Regufoam® are suitable for all kinds of vibration isolation of buildings:

- Full-surface foundation bedding
- Strip foundation bedding
- Pointed foundation bedding
- Vertical lateral vibration isolation
- Decoupling underneath the basement ceiling
- Vibration isolation of individual parts of buildings
- Room-in-room constructions
- Slotted walls in the transmission area between energy source and building

The Benefits

- Isolation effect can be adjusted to the specific requirements
- Choice of two different product lines for the most economical and technically best solution possible
- Precisely definable tuning frequency thanks to individual material thicknesses
Vibration Isolation of Building Foundations

Tasks

The vibrations which are caused by the source of the shock may spread throughout the building structure: they are perceived as noticeable vibrations, they can spread as secondary airborne sound, and when the worst comes to the worst, they can damage the building structure. What is more, the function of machines and measuring equipment in the building may be impaired.

The objectives of the vibration isolation of buildings are:
- health protection
- the protection of the building fabric
- the protection of the technical equipment inside the building

Shock is the common term for mechanical vibrations of solid bodies with a potentially damaging or disturbing effect.

Structure-borne sound refers to vibrations which, contrary to airborne sound, continue through a solid medium. Vibrations in liquids are called fluid-borne sound.

The transmission path of vibrations or of shock may include a change of media.

The protection of buildings against vibrations can be achieved through different measures:

1. Vibration-reducing measures at the place of the emission, e.g. a mass-spring system in a railway track.

2. Interruption of the transmission of the vibration in the transmission area, e.g. through a below-ground slotted wall or by shielding the basement walls.

3. Shock and structure-borne sound decoupling at the place of immission, underneath the building foundations and at the exterior side of the basement walls at the earliest. This is the measure most commonly used.

Most decoupling measures are taken at the building foundations and are called resilient bedding of buildings. Railway tracks are one of the most frequent causes of emission. Therefore the majority of the measures apply to resilient bedding of buildings for interfering frequencies between 25 and 100 Hz. Vibrations in this frequency range are critical, as they can lead to building component resonances and thus to secondary sound effects.

Consequently, the resilient bedding of buildings is intended to reduce the transmission of vibrations in the structure of the building with the help of the isolating material and by taking complex impact factors into account. Lowering the level to between 10 to 25 dB, depending on the frequency, is no problem at all with Regupol® and Regufoam®.
Types of Vibration Isolation of Buildings

The decision of which measures to take always depends on various impact factors and must be taken based on the individual case.

The vibrations to be expected at the place of immission (the building) depend on the composition of the frequency of the emission source, on the transmission via the specific ground, the coupling of the building and the continuation of the vibrations within the building structure.

Elastic decoupling is only effective if certain specifications are adhered to during the installation. Special care must especially be taken to make sure that there are no direct connections (structure-borne sound bridges) between the property to be protected and its surroundings.

As a rule, the existing situation should be assessed by taking vibration measurements. With the help of complex, computer-assisted calculation models the expert consultants can then come up with a forecast for the property and define the “target situation” of the resilient measure. The resulting requirements of support frequency and isolation effect make it possible to develop the optimum solution from an economical and technical point of view when Regupol® and Regufoam® are used.

Elastic decoupling is only effective if certain specifications are adhered to during the installation. Special care must especially be taken to make sure that there are no direct connections (structure-borne sound bridges) between the property to be protected and its surroundings.

The decision of where the resilient measure is to be applied at the building depends on the properties of the foundation. We distinguish between full-surface decoupling underneath the base plate, strip decoupling under strip foundations, the rising walls or point decoupling. When exterior building components touch the ground above the decoupling level, it is necessary also to decouple them vertically from the ground.

Impact factors for the transmission of vibrations.

Recommendation and coordination of specialist planners for building acoustics.
Find out more on Page 61 onwards.

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Downloads at www.bsw-vibration-technology.com
Full-Surface Decoupling

In full-surface decoupling, the entire base plate is separated elastically from the building ground. The elastomer is either applied on a thicker foundation course or on a specially dimensioned supporting plate.

To achieve optimum efficacy, the foundation should be as rigid as possible. Since it is a full-surface installation, the isolation can be performed quickly and easily, and the risk of acoustic bridges is very low, too.

The building loads are distributed over a large area of the subfloor. The degree of rigidity of the elastomers is selected by taking the different compression ranges into account. As a result, fairly even deflection of the entire base plate can be achieved.

The base plate and the adjoining structural components should also be as rigid as possible so as to avoid vibration of the structural components and dynamically activating large masses of material.

Finally, the elastomer must be covered with PE foil for protection against concrete slurries.
Strip Decoupling

Linear decoupling is a vibration isolation option for buildings with strip foundations. The width of the foundation should be such that the elastomers are used optimally by the load-bearing area to make sure that the best isolation effect can be achieved.

An alternative option is strip decoupling on the rising walls underneath the basement ceiling. With this method, it is also possible to do without vertical isolation of the exterior structural components towards the ground.

The adjoining structural parts, such as ceilings on top of the structural part, must be sufficiently rigid to avoid vibrations of the structure. Installation can be done either with in situ concrete or using prefabricated parts.

To prevent the penetration of concrete slurries into the elastomer, the latter should be protected by a PE foil with a thickness of at least 0.2 mm.
Point Decoupling

Because of the high point loads in foundations with poles and supports, elastomers with a high load-bearing capacity are typically used for vibration decoupling. The elastomers should already be included in the plan at an early stage to make sure that the vibration isolation can increase the security of the entire structure.

The pile cap structure can be optimised by keeping the pressure on the elastomer constant by varying the measurements. The result is an even deformation and isolation behaviour of the entire foundation construction and the elastomers.

The foundation structure should be rigid as well so as to activate adjoining parts of the overall structure as dynamic masses and to reduce structural vibrations.

The Clichy (France) Music School as a Real-Life Example

Decoupling of the building foundation of the Clichy Music School with Regupol® vibration damping material.

The red, blue and green fields indicate the installation of various Regupol® types.
Vertical Decoupling

In some cases it suffices to install a vertical partition at the exterior structural components in order to reduce vibrations. Vertical partitions are often installed between existing and to-be-constructed buildings.

In these applications there are diverse requirements of the elastomer. The more dynamically soft the material, the better the reduction of the vibration. However, it still has to be able to bear the loads that occur. These loads, which may be the result of earth or concreting pressure, may be up to 120 kN/m² and in exceptional cases even considerably higher.

Generally a plate-shaped, soft elastomer from the Regupol® group is used for this type of application. Even though they have a constant load-bearing capacity of up to 120 kN/m², Regupol® elastomers still have very low dynamic rigidity. Moreover, the material is insensitive to moisture and very quick to install thanks to the installation aids.

The material is available in plates of 1,000 x 500 x 50 mm as standard to ensure good handling. Depending on the requirements for the vertical isolation, the material can also be installed in double layers with 100 mm thickness. Special thicknesses (e.g. 25 mm) are available upon request.

The vertical isolation can be glued onto the partition wall. To this end the construction site must offer the usual gluing conditions such as a dry and dust-free surface.

Alternatively, the material can be nailed or plugged onto the wall with mounting aids, regardless of the weather conditions.

Prior to backfilling the site, the elastomer should be protected against sediments and sharp rocks by covering it with a geotextile.
Mounting

Gluing

The vertical isolation can be glued onto the partition wall. To this end the construction site must offer the usual gluing conditions such as a dry and dust-free surface.

Execution (Example)

Mechanical Mounting

Alternatively, the material can be nailed or plugged onto the wall with mounting aids, regardless of the weather conditions.
Light Mass-Spring Systems

Reliable Protection from Ground-Borne Vibration
Reliable Protection from Ground-Borne Vibration

Tramways and light-rail systems produce vibrations that can be transmitted via the ground into buildings. In the surrounding buildings these vibrations are felt as shaking and secondary airborne sound.

In densely built-up inner city areas light railways are usually critical in terms of secondary airborne sound. In the case of construction without elastic mounting, the secondary airborne sound levels are often above the indicated guideline values of the technical directives governing noise. Therefore it is standard practice today for new construction to be carried out using vibration-reducing methods.

From an engineering and acoustic point of view the most suitable solution is the light mass-spring system (LMSS) in combination with the elastic material Regupol®.
The Benefits

Reliability and Long-Term Experience

Regupol® is characterised in particular by its extreme durability. Even after many years of use the vibration-damping properties of the material are preserved. This has already been proven in various projects.

After fifteen years of use the Austrian Federal Railways confirmed their satisfaction with the material Regupol®. In addition to this, there is the positive experience of twenty years of use as elastic support under sleepers at Gütersloh station, Germany.

Regupol® is resistant to damp. Due to its drainage properties, larger quantities of water can be removed under the mat.

Engineering Advantages

During concreting the elastomer mat acts as a “lost shutter”. This makes for a rapid and secure method of construction.

In contrast to other forms of construction with an elastic separation layer the light mass-spring system can be used continuously in areas with points. The transition between different elastic mountings can be bridged by using various mat types with defined deflection.

Operational Safety

Operational safety requirements are met by a light mass-spring system as impermissible gauge expansion cannot occur due to the elastic mounting.

Deflections under the relevant loadings are precisely defined and can be determined and adjusted for each type of use.
Regupol® for Use in Rail Traffic

Depending on the requirement and purpose of use, various types of Regupol® can be used as elastic insulation. To increase the insertion loss effect they can also be installed in multiple layers.

The advantage of Regupol® is the practically constant natural frequency over a broad load range. This ensures much greater planning reliability for the specialist planner.

The stiffness of the elastic mounting and the effectiveness of the insulation associated therewith can be adapted to the relevant requirements.

Technical Data for Regupol® SB 16/100prof

In already constructed light mass-spring systems the material Regupol® SB 16/100prof has been shown to have an excellent record. It was specially developed for use in inner-city rail traffic.

Spring Characteristics of Various Materials

In contrast to other materials, Regupol® has progressive spring characteristics. This results in reduced deflection in the traffic load area. No critical deformation can occur, even in the event of short-term overloading.

Recommendation and coordination of specialist planners for building acoustics. Find out more on Page 61 onwards.
Application Example Portugal

Test Results Almada, Portugal

The light mass-spring system designed with Regupol® SB 16/100prof in Almada, Portugal, can be used by road traffic. This manner of construction in Almada could be employed without special sealing of the vertical isolation. The diagram below shows the course of the measured insertion loss via the frequency ratio of the natural frequency of the elastic mounting to the disturbing frequency.

The picture on the left shows the laying of Regupol® SB 16/100prof, a tried and tested elastic intermediate layer for light mass-spring systems, in Almada, Portugal.

Regupol® has proved to be successful in controlling vibrations in many building projects.

References (Extract)

Germany
Hamburg

Austria
Innsbruck, Vienna, Graz

Italy
Milan

Portugal
Almada

Serbia
Belgrade

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Services
Impact Sound Insulation
Vibration Isolation

Technical Data
Software
Consulting
Planning Information for Vibration Isolation and Impact Sound Insulation

We will provide specialist planners on request with our comprehensive technical catalogue, which includes more than 140 pages describing our products for vibration insulation and heavy-duty impact noise insulation. The catalogue contains information on the most important physical properties of all 12 types of Regufoam® vibration and all 8 types of Regupol® vibration. It further includes the technical documentation of the four impact noise insulation sheets to be used under the concrete screed and BSW’s other heavy-duty impact noise insulation products. This technical information is essential for the professional planning of vibration engineering and building acoustics construction measures using Regufoam® and Regupol®.

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BSW product finder Calculation Software

The BSW product finder calculation software is an important support tool for the design of vibration engineering measures. The program is easy to use, determines the right types of Regufoam® and Regupol® vibration within a short time and calculates the achievable insulation effect of the vibration engineering measure.

This program can significantly reduce the work time required by a specialist planner and can quickly and reliably provide the customer with the results required.

The BSW product finder is available from BSW on request and can be installed on a personal computer.

The user interface is available in German and English and other language versions are in preparation.

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The BSW product finder will be provided on request.

The calculation results extend over five pages and can be stored in PDF format or printed.

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Downloads at www.bsw-vibration-technology.com
All Tools for the Download

You will find all documents and information which you need for making a decision, for calculation as well as the installation and application of the BSW vibration technology products, at www.bsw-vibration-technology.com. In a matter of seconds you can download technical datasheets, certificates and installation instructions, all in the required file formats.

The website www.bsw-vibration-technology.com serves mainly as a planning basis for architectural acoustics and construction engineers. You must register to use the technical documents. BSW will send you your user name and password right away. Since being put up in January 2010, this website already has several hundred registered users. The resulting community of technical planners is increasingly linked by BSW. Thus many non-specialised architects who are planning a building with vibration insulation already benefit from BSW’s technical planning service.

The information provided on our website and in the PDF versions of this catalogue represents the latest content version.
BSW specialist planner service

The dimensioning of vibration insulation measures is the task of a specialist planner. Only such a planner can evaluate the complex building dynamics situation.

BSW specialises in the production of high-performance elastomers for a broad range of vibration insulation tasks. This includes the use of elastomers for impact noise insulation in heavy-duty areas and extends to elastomers for the use in rail traffic or vibration reduction for building foundations.

Specialist planners / consultants handle the complex tasks involved in a comprehensive building dynamics analysis. We have completed a large number of projects, have many years of experience and will gladly refer you to an appropriate specialist planner who has the specialist knowledge to deal with your requirements.

BSW provides building dynamics specialist planners with extensive technical data and experience with the materials Regupol® and Regufoam®. In case the standard range of BSW does not provide a solution, the specialist planner may develop a suitable, individual solution in cooperation with BSW.

The download area

www.bsw-vibration-technology.com

provides specialist planners with extensive information concerning the special elastomers Regupol® and Regufoam®.

BSW recommends the use of BSW specialist planner services.

Please proceed as follows:

Ask the BSW customer consultant for specialist planners for your project.

BSW will support you by referring specialist planners who are specialised to deal with your requirements.

The engineering bureau contracted by you will provide an optimal building acoustic or vibration engineering solution taking into account technical and economic aspects.

BSW and the relevant engineering bureau will also be available to assist you during installation.

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