



RAUPIANO PLUS

THE VERSATILE ACOUSTIC DRAINAGE SYSTEM

TECHNICAL INFORMATION

RAUPIANO PLUS

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Notes on this technical information

Applicability

This technical information is applicable for Australia and New Zealand.

Navigation

At the beginning of this document, you can find a detailed content page which lists the individual chapters and their respective page numbers.

Pictograms and logos

-  Safety information
-  Legal information
-  Important information
-  Information on the Internet
-  Advantage



For safe usage of REHAU products, please check regularly if a newer version of the technical information is available to you.

The date of issue of your technical information is always printed at the bottom left of the cover page.

The current technical information is available from your REHAU sales office, specialist wholesaler as well as on the Internet as a download at:

www.rehau.com.au or www.rehau.co.nz



- Read the safety recommendations and operating instructions carefully and completely for your own safety and for the safety of other people before starting with the installation.
- Retain the operating instructions and keep them handy.
- If you do not understand the safety recommendations or installation instructions, or if they are unclear, contact your REHAU sales office.

RAUPIANO PLUS

SYSTEM INTRODUCTION

Intended use

The drainage system RAUPIANO PLUS may only be installed and operated as described in this technical information. Any other use is unintended and therefore impermissible.



General safety measures

- Observe all applicable national and international regulations on installation, accident prevention and safety, together with the information contained in this manual.
- Keep the work place tidy and free of obstructions.
- Ensure there is always sufficient light.
- Keep children, house pets and unauthorised persons away from tools and installation area. This is especially important in cases of renovation in occupied areas.

Fire protection

Observe the applicable fire-protection regulations very carefully as well as the codes/regulations of building practice that apply in each case, especially in relation to:

- Penetrating through fire compartments.
- Rooms subject to the guideline of places of assembly places.

Personnel requirements

- Allow only authorised and trained persons to assemble our systems.
- Work on electrical systems or pipe components may only be performed by persons trained and authorised for this purpose.

Work clothing

- Wear protective glasses, suitable work clothing, safety shoes, a protective helmet and, if you have long hair, a hair net.
- Do not wear loose clothing or jewellery. They could be caught by moving parts.
- Wear a protective helmet when performing assembly work at head level or above your head.

When assembling the system

- Always read and comply with the respective operating instructions of the tool used.
- The cutting tools have a sharp blade. The cutting tools are to be stored and handled in a safe way to prevent injuries.
- When shortening pipes, maintain a safe distance between the hand holding the object and the cutting tool.
- Never put your hands near the area where the tool is cutting or on moving parts.
- When performing service, maintenance and conversion work and when changing the place of assembly, always unplug the power cable of the tool and secure it against being switched on inadvertently.

2.1 Function

RAUPIANO PLUS is a versatile sound-insulating drainage pipe system for non-pressurised site drainage in accordance with AS/NZS 3500.2. It can be used as drainage system for all building types from one-family houses to large buildings.

RAUPIANO PLUS is available in nominal diameter DN 40 to DN 200.

A comprehensive fitting, adaptors and bracket range complete the system. They are characterised by the following features:



- Excellent sound-insulation properties
 - Mineral-filled material for pipes and fitting to reduce air-borne noise
 - Partially thickened walls for bend fittings to improve air-borne insulation
 - Special sound-dampening bracket to reduce transmission of structure-borne noise
- Fast and easy installation
- The joint is designed to absorb any thermal expansion
- High quality product
 - Excellent impact resistance - robust for transport, storage and handling at construction site
 - High UV-resistance, can be stored outdoor for 1 year
 - Smooth yet abrasion-resistance inner layer to reduce risk of deposits and scaling
- Green material, non-toxic material without halogen

2.1.1 Residential buildings

RAUPIANO PLUS is a versatile system for non-pressurized drainage systems which are installed according to AS/NZS 3500.2. It is able to comply with the requirements of Building Code of Australia (BCA) for different types of residential buildings, such as:

- One-family houses
- Multi-storey apartment blocks
- Condominiums

2.1.2 Commercial buildings

RAUPIANO PLUS, with its special acoustic characteristics, can also be installed in commercial buildings that require stricter acoustic requirements such as:

- Hotels
- Office buildings
- Hospitals

RAUPIANO PLUS meets the increasing need for peace and quiet and ensures a high level of living comfort.

The pipe dimensions in accordance with AS/NZS 7671 allow trouble-free transition to HT-PP which is manufactured according to EN 1451 or EN 1401 with pipes and fittings of the same nominal diameter without the need for special transition/adaptor pieces.

2.1.3 Commercial kitchens

RAUPIANO PLUS is ideal for use as a collecting and ground pipe for drainage of greasy waste water from commercial kitchens up to the grease separator.

For grease separators at a great distance, the use of pipe trace heating may be necessary. This prevents premature grease accumulation. The temperature of the pipe trace heating suitable for plastic pipes may not exceed 45°C.

2.2 Application



Fig. 2-1 RAUPIANO PLUS pipes and fittings.

The sound-insulating drainage system RAUPIANO PLUS is suitable for gravity drainage systems in accordance with AS/NZS 3500.2 as certified under Watermark WM70060 in buildings. Local national standards, code of practice and regulations must be observed during the design and installation of RAUPIANO PLUS system.

The pipes, fittings and seals can be operated continuously at 90°C (and up to 95°C for brief periods). They are suitable for the drainage of chemically aggressive waste water with a pH value of 2 (acidic) to 12 (basic).

Behaviour in fire corresponds to B2 normal combustibility according to DIN 4102 and D-S3,d0 according to EN 13501-1.

The pipe connections are leak-proof up to an internal excess water pressure of 1 bar (10 m water column).

Pipes and fittings may not be used for:

- installation subjected to continuous operating temperature higher than 90°C (or higher than 95°C for brief periods)
- carrying waste water containing prohibited chemicals (see section 10)
- exposed installation to UV radiation directly and indirectly

If used in cold areas, where installations are commonly done under temperature below -10°C, additional tests are required according to AS/NZS 7671.

RAUPIANO PLUS has passed the test and therefore marked with the "ice crystal" according to AS/NZS 7671 and DIN EN 1411 and can be installed in these regions.



For outlet of ventilation lines, use pipes suitable for outdoor installation instead of RAUPIANO PLUS.



Observe all applicable national and international regulations on installation, accident prevention and safety, together with the information contained in this manual.

Areas of application which are not included in this technical information (special applications) require consultation with our technical department. Please contact your REHAU sales office.

2.3 Pipe structure

The RAUPIANO PLUS multi-layer pipe construction achieves superior properties through the application of distinct functional layers combined in a composite construction.

Three separate layers impart unique characteristics to the pipe. The abrasion resistant, low friction inner layer ensures the easy transit of waste. The mineral filled mid-layer ensures superb sound dampening properties and also offers increased stiffness. Finally, the robust outer layer is tough enough to withstand impacts and shocks.

Combined together, the composite layers create a tough, durable pipe, with outstanding acoustic properties that gives all the functionality of a drainage pipe system combined with the noise absorption properties of lagging.

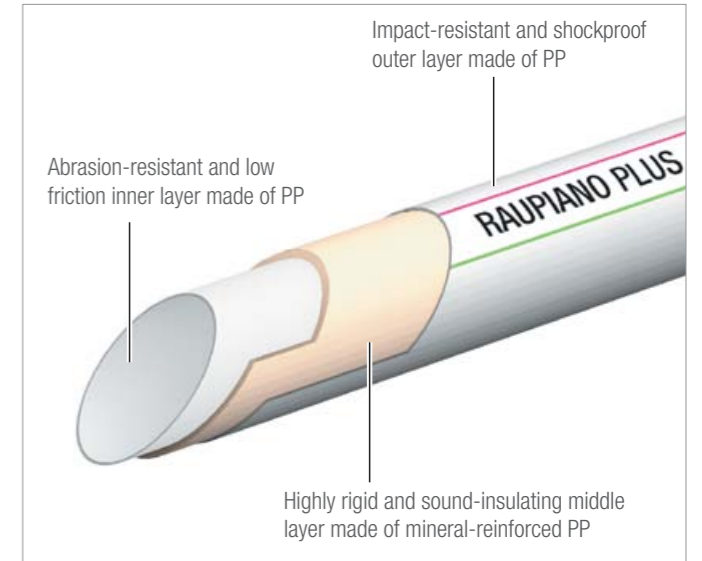


Fig. 2-2 RAUPIANO PLUS pipe structure.



- RAUPIANO PLUS – robust for transport, storage and handling at the construction site.
- Fracture resistant at -10°C.
- Can be stored outdoors for up to 1 year.
- Optimum hydraulic characteristics. Accumulation of deposits and incrustations are reliably prevented.

These ideal characteristics are achieved thanks to the three-layer structure of the pipe and the specialised adaptation of each individual layer to its respective requirement:

- High ring stiffness
- Excellent impact strength of the outer layer at low temperature
- Increased UV-resistance
- Abrasion-resistant and smooth inner layer
- Highly rigid and sound-insulating middle layer made of mineral-reinforced PP

2.4 Fittings

The pipe system can experience local vibrations at redirections due to critical drainage conditions. This can have a negative effect on sound-related properties.

To minimise this effect and counteract negative influences, targeted mass optimisation was carried out in sound-critical areas of elbows with a nominal width of DN 90 to DN 160. This stabilises the sound behaviour, reduces sound generation and thus achieves even better noise damping in the impact area.



Fig. 2-3 RAUPIANO PLUS bend with reinforced impact area.

2.5 Sound insulation

The sound-insulating drainage system RAUPIANO PLUS offers quality, quietness and living comfort in important areas of a building. REHAU RAUPIANO PLUS system has been independently tested by a member of the Association of Australian Acoustical Consultants (AAAC) at the National Acoustic Laboratories (NAL). Test results were assessed by a separate AAAC member to ensure impartiality of the report. The report found conclusively that RAUPIANO PLUS pipe system exceeds the $R_w + C_{tr}$ 40 requirement of the BCA/NCC, and that a stand alone RAUPIANO PLUS system is comparable, in terms of sound insulation, to a fully lagged PVC system.



- Excellent sound insulation
- High pipe rigidity (ring stiffness $> 4 \text{ kN/m}^2$ in accordance with DIN EN ISO 9969)
- Optimum hydraulics thanks to an extremely smooth and low-friction inner layer
- Improved handleability thanks to a tough outer layer
- Excellent impact strength at extremely low temperatures (ice crystal in accordance with AS/NZS 7671 and DIN EN 1411)
- Safe to install at low temperatures
- Easy and fast installation
 - Push-fit socket joint
 - Sealing rings installed at the factory
 - Shortened with common pipe cutters or saw
- Complete pipe, fitting, adapters and bracket range
- Universal compatibility with the HT-PP system, connection to common HT and KG pipes without special adapters
- Attractive appearance in visible areas
- Sanitary white colour
- Environmentally friendly – can be recycled

2.6 System components

Pipes and fittings

- Made of mineral-reinforced RAU-PP
- Dyed white (similar to RAL 9003)
- Nominal diameter DN 40, 50, 75, 90, 110, 125, 160, 200
- Available in lengths from 150 mm to 3,000 mm
- Complete fitting range
- Bend from 15° to 87° (DN 90 to DN 160 in thicker-walled version)
- Single branch
- Double branch
- Corner double branch
- Parallel branch
- Floor Waste Gullies
- Additional special fittings

Seals

The pipes and fittings are equipped with a lip sealing ring at the factory in accordance with DIN 4060 and DIN EN 681-1.

Hardness: 60 ± 5 Shore A

Material: Styrene butadiene rubber (SBR)

Fastening elements



Fig. 2-4 Patented sound dampening support bracket.

- Sound dampening support bracket
- Fixing clamp
- Guiding clamp

Fire protection



The fire behaviour is in accordance with material class B2 in accordance with DIN 4102. The national fire-protection regulations and the respective applicable codes/regulations of building practice are to be observed here.

REHAU RAUPIANO PLUS has been independently tested and assessed in combination with Promat fire stopping devices in accordance to AS 1530.4.

Optional, REHAU fireproofing collars are available for penetration of the RAUPIANO PLUS pipe through fire-resistant ceilings or walls. REHAU fire collars are tested according to BS 476 and assessed by independent third party (CSIRO) to conform to AS 1530.4.



Fig. 2-5 "Compact" fireproofing collar.

RAUPIANO PLUS

SOUND INSULATION

2.7 Transportation and storage

Packaging

- Pipes up to 500 mm and fittings are packed in a box
- Pipes 750 mm and longer are packed in wooden crates

Transportation

RAUPIANO PLUS proves its robustness during transport and at the construction site thanks to its three-layer structure and impact-resistant and shock-proof outer layer. Ensure that pipes make firm contact over their entire length.

Storage

- Protect boxes from wetness during transport and storage.
- RAUPIANO PLUS and its seals can be stored outdoors for up to 1 year due to its UV-stable characteristics.

We recommend:

- Protecting RAUPIANO PLUS pipes and fittings from direct sunlight and soiling by:
 - storing in the box
 - covering them with tarpaulins (ensure proper ventilation).
- Stack no more than four wood crates on top of one another.
- Ensure that the wood frames are aligned squarely when stacking.
- Store pipes in such a way that no objects are placed on top of the sleeves and insertion ends and that these are not deformed.

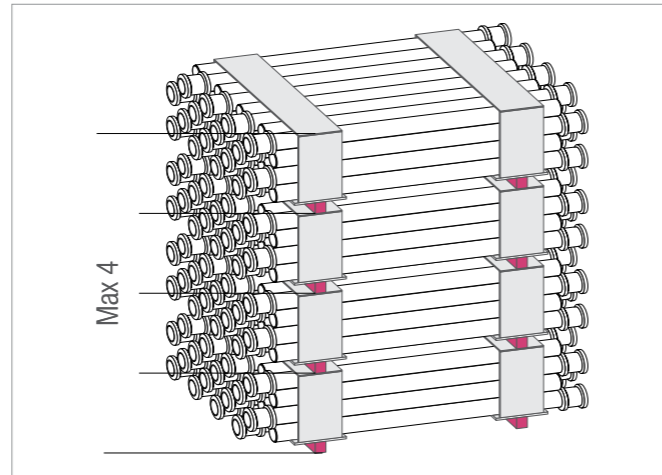


Fig. 2-6 Recommended storage of RAUPIANO PLUS.

2.8 Marking

Pipes and fittings are marked with the following:

- Manufacturer's mark
- Approval number
- Mark of quality
- Ice crystal (AS/NZS 7671 and DIN EN 1411)
- Nominal diameter (DN)
- Year of manufacture
- Production plant
- Material
- Angle specification (with elbows and branches)

2.9 Recycling

RAUPIANO PLUS pipes and fittings are 100% recyclable.

3.1 Basics

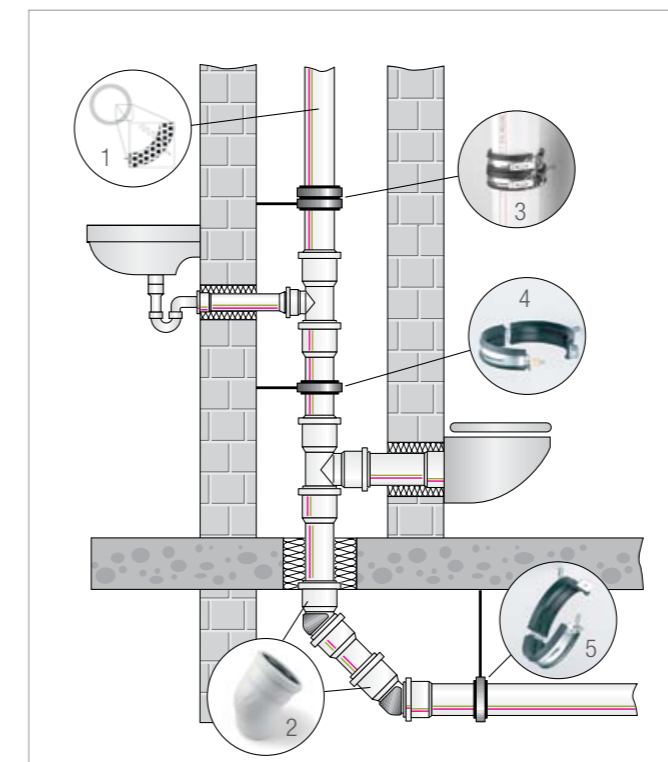
In every area of building construction, especially the construction of multi-storey apartment blocks, hospitals and rehabilitation homes, sound insulation plays an increasingly important role. One of the most significant sources of sound within buildings is the sanitation set-up and the accompanying drainage water pipe system.

Typical sources of sound include:

- Fitting noises
- Filling noises
- Draining noises
- Inlet noises
- Impact noises

Unsuitable drainage pipe system and type of brackets are considerable contributors to disturbing noise. RAUPIANO PLUS, a system-tested, versatile sound-insulating drainage water system, puts things right.

A differentiation is made between air-borne noise and structure-borne noise, depending on the propagation medium.



Air-borne noise

Air-borne noise is present if the noises of a sound source are transferred directly through the air to human ears.

Structure-borne noise

With structure-borne noise, the sound transfer first occurs through a solid body. This body vibrates and passes the vibrations on to human ears as airborne noise.

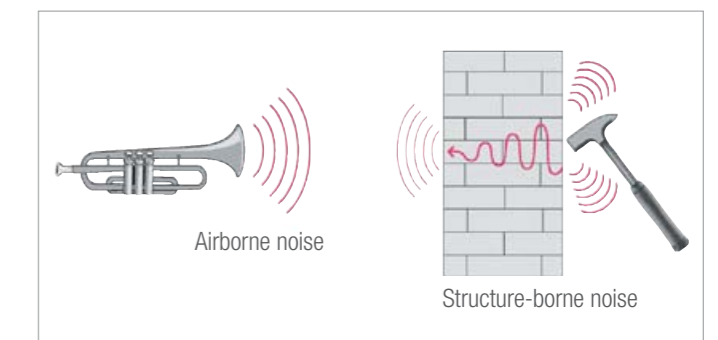


Fig. 3-2 Air-borne and structure-borne noise.

Fig. 3-1 Noise reduction measures with RAUPIANO PLUS.

Air-borne noise reduction through:

1. Special pipe and fitting materials
2. Mass optimisation in the redirection area of fittings

Structure-borne noise reduction through:

3. Patented sound-proof attachment
4. Optimised guiding clamp
5. Fixing clamp with elastomer insert

3.2 Sound insulation requirements

3.2.1 Australia

Sound insulation requirements differ from country to country and from one building type to another. In Australia the NCC / BCA Volume One Part F5 outlines the requirements for sound insulation:

- F5.6 Sound insulation rating of services

NCC/BCA Acoustic requirement

The NCC / BCA specifies that if a pipe that is located in a wall or floor cavity, serves or passes through more than one sole-occupancy unit, the pipe must be separated from the rooms by construction with an $R_w + C_{tr}$ of:

- 40 if the adjacent room is habitable (other than a kitchen); or
- 25 if the adjacent room is a kitchen or non-habitable

Weighted sound reduction index (R_w) is the number used to rate the effectiveness of a system as a noise insulator. An increase in one R_w unit approximately equals a reduction of one decibel in noise level.

Weighted sound reduction index plus spectrum adaptation term ($R_w + C_{tr}$) takes into account the lower frequency noise. C_{tr} is a negative number, so $R_w + C_{tr}$ value will always be lower than R_w value.

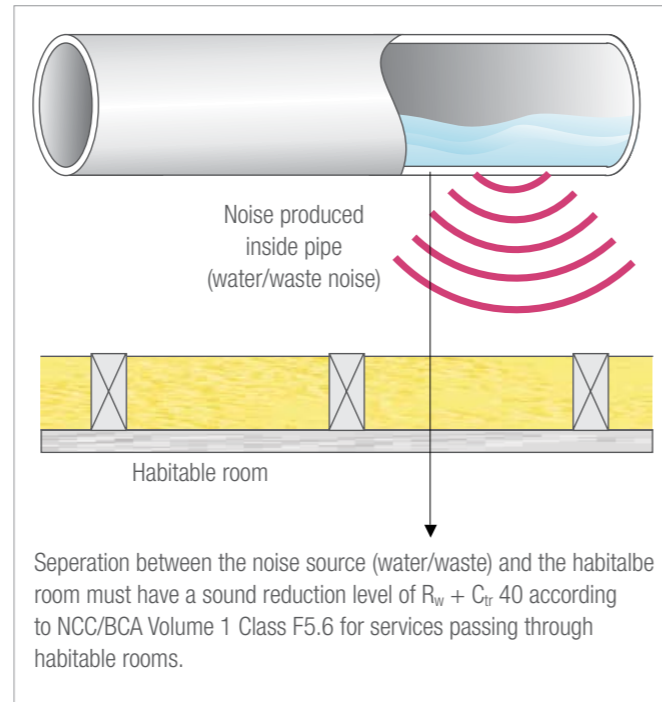


Fig. 3-3 NCC/BCA Acoustic requirement.

Separation between the noise source (water/waste) and the habitable room must have a sound reduction level of $R_w + C_{tr}$ 40 according to NCC/BCA Volume 1 Class F5.6 for services passing through habitable rooms.

3.3 Sound reduction with RAUPIANO PLUS

Both structure-borne and air-borne noises occur in drainage pipe systems. The wall of the pipe vibrates due to currents and flow noises. The type and intensity of these pipe vibrations depend on a variety of factors, such as the mass of the pipe, the pipe material and its inner damping.

The pipe vibrations are emitted directly from the pipe as air-borne noise and are transferred as structure-borne noise via the pipe brackets to the wall.

When developing a sound-insulating drainage water system, both types of noise distribution must be taken into account.

Airborne noise insulation with RAUPIANO PLUS

Airborne noise is reduced by RAUPIANO PLUS thanks to special materials, sound-dampening fillers and increased weight of the pipe system. Targeted mass optimisation in sound-sensitive areas of fitting elbows of nominal diameter DN 90 to DN 160 provides further improvement at redirection points.

Structure-borne noise insulation with RAUPIANO PLUS

The transmission of structure-borne noise to the wall is reduced with RAUPIANO PLUS with the use of patented, sound dampening brackets:

- A supporting clamp with loose gap in the pipe is fastened to the wall
- A fastening clamp rests onto the supporting clamp, keeping the pipe in position

This extensive physical decoupling of the pipe, bracket and wall means that the transmission of structure-borne noise is eliminated to a high degree (see Chapter 7).

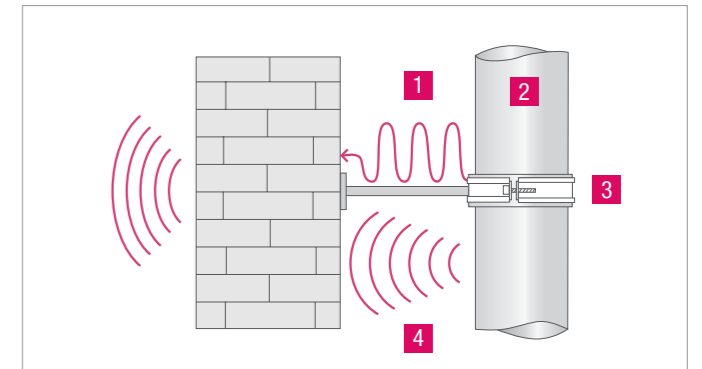


Fig. 3-4 Sound distribution with sewer pipe systems.

- 1 Structure-borne noise
- 2 Standard drainage pipe
- 3 Standard bracket (pipe clamp with/without rubber ply)
- 4 Airborne noise

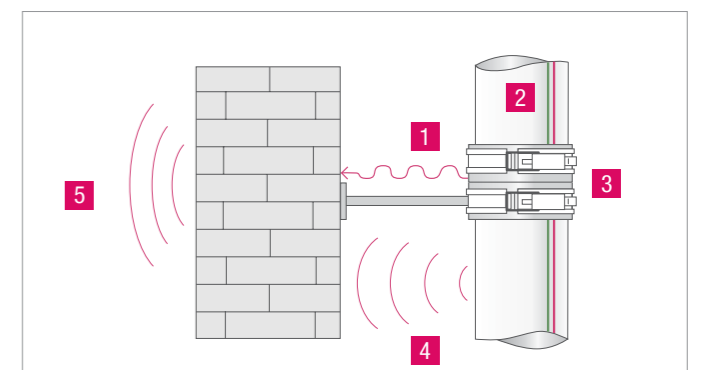


Fig. 3-5 Sound insulation with RAUPIANO PLUS.

- 1 Reduction of structure-borne noise
- 2 RAUPIANO PLUS pipe with sound-dampening fillers
- 3 RAUPIANO PLUS bracket, patented sound-dampening support bracket
- 4 Reduction of airborne noise
- 5 Reduced overall noise level

3.4 Laboratory testing of sound-insulation behaviour

3.4.1 Acoustic testing

Acknowledging the different installation practices and the effects on acoustic level reading in the building, REHAU assessed the acoustic performance of RAUPIANO PLUS system in National Acoustic Laboratory (NAL).

RAUPIANO PLUS pipe system has been independently tested using an established acoustic industry test based on ISO 140 test methodology and independently rated to ISO 717, then assessed in accordance with the requirements of the NCC/BCA.

The acoustic test was done to ensure full compliance of RAUPIANO PLUS with the acoustic requirements of Building Code of Australia. The tests were done with full-toilet-flush and half-toilet-flush.

Acoustic test results

Comparative testing results showed that using the RAUPIANO PLUS system achieves the same $R_w + C_{tr}$ value as a PVC system lagged with Pyrotek Soundlag 4525 C acoustic lagging.

The superior sound insulation properties of the RAUPIANO PLUS system mean it can be installed where an $R_w + C_{tr}$ value of 40 is required without lagging.

| Pipe | PVC | RAUPIANO PLUS |
|---------|--|--|
| Lagging | Pyrotek Soundlag 4525 C | None |
| Ceiling | 75mm R1.5 glass wool acoustic insulation batts | 75mm R1.5 glass wool acoustic insulation batts |
| | 13mm standard plasterboard | 13mm standard plasterboard |

Table 3-1 Comparative testing results.



RAUPIANO PLUS system tested with industry standard suspended ceiling achieved $R_w + C_{tr}$ 42, which means RAUPIANO PLUS exceeds BCA's acoustic requirements in habitable areas without acoustic lagging.

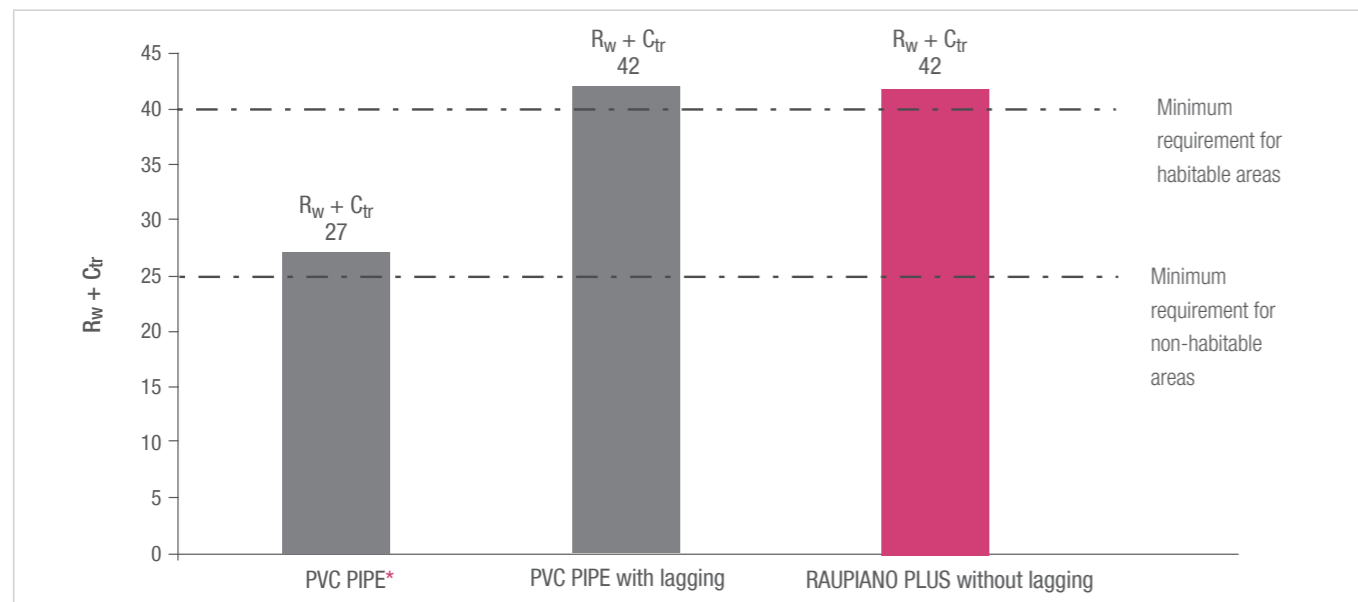


Fig. 3-6 Acoustic testing.

* Industry standard as recommended by Graeme E Harding and Accessories

Acoustic result interpretation

Based on the test result of the acoustic test in NAL, RAUPIANO PLUS is able to fulfill BCA's acoustic requirements with the following configurations:

| $R_w + C_{tr}$ (BCA requirement) | Type of room | Configurations |
|-------------------------------------|---|--|
| 25 | - Bathroom - Wet areas - Open kitchen | RAUPIANO PLUS with: - 10 mm standard plasterboard |
| 40 | - Bedroom - Living room | RAUPIANO PLUS with: - 13 mm standard plasterboard - 75mm R1.5 glass wool acoustic insulation batts |

Table 3-2 System configurations to fulfill or exceed BCA's acoustic requirements.



The behaviour of RAUPIANO PLUS in a fire corresponds to material class B2 (normally inflammable) in accordance with DIN 4102, Part 1.

4.1 Fire-protection requirements

With regard to drainage pipes, fire-protection measurements may be necessary if pipes penetrate through fire-rated building elements in a building.



With regard to fire protection, the applicable national regulations and the valid codes/regulations of building practice are to be observed.

4.2 Fireproofing collars

For fire protection of penetrations through fire-rated ceilings and walls, it is compulsory to install suitable fireproofing collars that will not reduce the fire-rating of the particular building elements.

We recommend to always get an approval from the responsible construction authority for compliance with the respective requirements.



Wall penetrations require two collars (on both sides of wall).



- When planning and assembling the fireproofing collars, the requirements of the general building construction approval and the specifications of the assembly instructions must be observed.
- When using the fireproofing collars, the applicable national regulations must be observed.



RAUPIANO PLUS system can be installed with suitable fireproofing collars, such as REHAU fireproofing collars or Promat fireproofing collars. These fireproofing collars have been tested and proven according to AS 1530.4 to fulfill the fire protection requirements from NCC/BCA.

Please contact your nearest REHAU Sales Office to get the detailed test report of the fireproofing collars.

4.2.1 REHAU Fireproofing collars

RAUPIANO PLUS offers complete system for drainage, including fireproofing collars suitable for RAUPIANO PLUS pipes and fittings. The following fireproofing collars are available:

REHAU PLUS fireproofing collar system

- For recessed installation in the wall and ceiling
- For installation on the wall and ceiling

REHAU Compact fireproofing collar system

- For installation on the wall and ceiling

REHAU angled fireproofing collar system

- For installation on a ceiling with angled penetration
- For installation on a ceiling on RAUPIANO PLUS pipe or fitting socket

REHAU compact fireproofing collar

| RAUPIANO PLUS pipes Fire Resistance Ratings/Levels | DN 40 | DN 110 Load bearing / Integrity / Insulation | DN 160 |
|--|-----------|---|-----------|
| Wall construction: An aerated concrete block wall, normally 1800 mm x 180 mm constructed from blocks of dimensions 440 mm long x 210 mm deep x 100 mm thick - protected by fire collar on both sides | -/120/120 | -/90/90 | -/120/120 |
| Floor construction: An aerated concrete floor with 150 mm thickness | -/180/180 | -/120/120 | -/120/120 |

Table 4-1 Fire resistance ratings/levels achieved by RAUPIANO PLUS pipes and REHAU compact fireproofing collar

REHAU PLUS fireproofing collar

| RAUPIANO PLUS pipes Fire Resistance Ratings/Levels | DN 40 | DN 110 Load bearing / Integrity / Insulation | DN 160 |
|--|-----------|---|-----------|
| Wall construction: An aerated concrete block wall, normally 1800 mm x 180 mm constructed from blocks of dimensions 440 mm long x 210 mm deep x 100 mm thick - protected by fire collar on both sides | | | |
| - Fire collar installed with face mounted | -/240/180 | -/240/120 | -/120/120 |
| - Fire collar intalled with recess | - | -/180/180 | - |
| Floor construction: An aerated concrete floor with 150 mm thickness | | | |
| - Fire collar installed with face mounted | -/240/240 | -/180/180 | -/180/180 |
| - Fire collar intalled with recess | - | -/180/180 | - |

Table 4-2 Fire resistance ratings/levels achieved by RAUPIANO PLUS pipes and REHAU PLUS fireproofing collar

REHAU angled fireproofing collar

| RAUPIANO PLUS pipes Fire Resistance Ratings/Levels | DN 75 | DN 125 |
|--|---------------------------------------|-----------|
| | Load bearing / Integrity / Insulation | |
| Wall construction: An aerated concrete floor with 150 mm thickness | | |
| - Plain pipe penetrating at 45° angle | -/240/120 | -/120/120 |
| - Plain joint penetrating at 90° angle | -/180/180 | - |

Table 4-3 Fire resistance ratings/levels achieved by RAUPIANO PLUS pipes and REHAU angled fireproofing collar

When using fireproofing collars in the ceiling, they can be assembled immediately or subsequently, depending on their type.

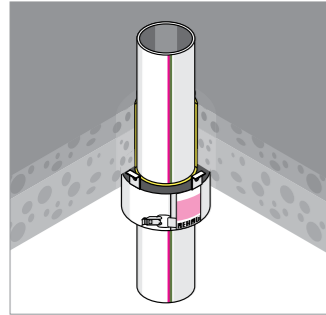


Fig. 4-1 Installation of fireproofing collar in ceiling

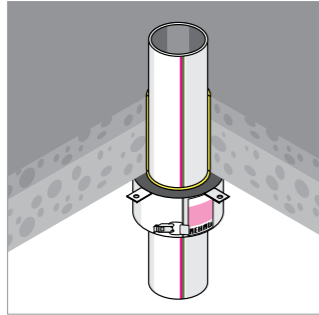


Fig. 4-2 Installation of fireproofing collar on ceiling

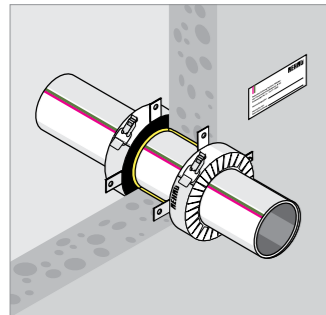


Fig. 4-3 Installation of fireproofing collar on wall

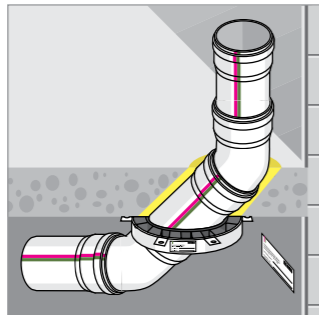


Fig. 4-4 Installation of fireproofing collar (only for installation on ceiling)



REHAU Fire Collars are tested according to BS 476 and have been assessed by independent third party (CSIRO) to conform to AS 1530.4. Assessment report is available upon requested.

To reuse REHAU angled fireproofing collar system on penetration of drainage pipe through concrete ceiling at an angle, a minimum ceiling distance of 50 mm is required for the horizontal drainage pipe running below the concrete ceiling.

4.2.2 PROMAT fireproofing collars

The following PROMAT fireproofing collars can be used together with RAUPIANO PLUS system:
 - PROMASEAL FC Retrofit collar
 - PROMASTOP Unicollar

RAUPIANO PLUS has been independently tested and assessed in conjunction with Promat fire protection devices to AS 1530.4. The following fire protection collars are available:

Promat PROMASTOP® Unicollar
 - For 40mm - 110mm pipe in wall and ceiling applications

Promat PROMASEAL® FC Collar
 - For 125mm - 200mm pipe in wall and ceiling applications

Contact your local REHAU sales office for additional fire protection solutions and test data.

Wall penetrations with RAUPIANO PLUS pipes

Wall construction:

128mm thick steel framed plasterboard lined wall

| REHAU RAUPIANO PLUS pipes | DN 40 | DN 50 | DN 75 | DN 90 | DN 110 | DN 125 | DN 160 | DN 200 |
|---|-----------|--|------------|------------|-----------|-----------|-----------|-----------|
| Fire Resistance Ratings/Levels | | Structural adequacy (n/a) / Integrity / Insulation | | | | | | |
| Promat PROMASTOP UniCollar - protected by fire collar on both sides of the wall | -/240/180 | -/240/120* | -/240/120* | -/120/120* | -/240/120 | - | - | - |
| Promat PROMASEAL FC Collar - protected by fire collar on both sides of the wall | - | - | - | - | - | -/240/120 | -/240/180 | -/240/180 |

Table 4-4 Fire resistance ratings/levels achieved by RAUPIANO PLUS pipes with Promat fire collars in wall penetrations.

Floor penetrations with RAUPIANO PLUS pipes

Floor construction:

120mm concrete slab

| REHAU RAUPIANO PLUS pipes | DN 40 | DN 50 | DN 75 | DN 90 | DN 110 | DN 125 | DN 160 | DN 200 |
|---|-----------|--|------------|------------|-----------|-----------|-----------|-----------|
| Fire Resistance Ratings/Levels | | Structural adequacy (n/a) / Integrity / Insulation | | | | | | |
| Promat PROMASTOP UniCollar - protected by fire collar on the fire exposed side only | -/240/120 | -/120/120* | -/120/120* | -/120/120* | -/180/120 | - | - | - |
| Promat PROMASEAL FC Collar - protected by fire collar on the fire exposed side only | - | - | - | - | - | -/240/120 | -/240/180 | -/240/120 |

Table 4-5 Fire resistance ratings/levels achieved by RAUPIANO PLUS pipes with Promat fire collars in floor penetrations.

* Result is derived from PROMAT test data based on identical fire protection devices tested with PVC pipe systems.

5.1 Measurement basics

The planning and installation of RAUPIANO PLUS drainage system shall comply to AS/NZS 3500.2.

The goal is to ensure intended functioning of the universal drainage system RAUPIANO PLUS, i.e.

- Back siphoning and leaking of water seal column must be prevented
- Ventilation of the drainage system must be ensured
- Nominal diameter larger than those calculated are not to be used to ensure effective drainage
- Sewage must drain with little noise
- Anaerobic digestion is to be prevented
- Gas emissions are to be lead out without harmful effects via the main ventilation system

5.2 Equivalent pipe sizes

Pipe sizing chart

| PVC | | RAUPIANO PLUS | |
|-----|---------|---------------|---------|
| DN | OD (mm) | DN | OD (mm) |
| 40 | 43 | 40 | 40 |
| 50 | 56 | 50 | 50 |
| 65 | 69 | 75 | 75 |
| 80 | 82 | 90 | 90 |
| 100 | 110 | 110 | 110 |
| - | - | 125 | 125 |
| 150 | 160 | 160 | 160 |
| 175 | 200 | 200 | 200 |

Table 5-1 Equivalent pipe sizes.



When connecting RAUPIANO PLUS directly to PVC systems, some dimensions require connection adapters. Refer to chapter 6.7 for details.

5.3 Specification

General

RAUPIANO PLUS system is suitable for drainage system installed above ground and inside the building.

Standards

| | |
|---------------|---|
| NCC/BCA | National Construction Code / Building Code of Australia |
| AS/NZS 3500.2 | Plumbing and drainage – Sanitary plumbing and drainage |
| AS/NZS 7671 | Plastic piping systems for soil and waste drainage (low and high temperature) inside buildings - Polypropylene (PP) |

Approval in Australia and New Zealand

RAUPIANO PLUS pipes and fittings are certified under Watermark WM70060 for sizes DN 40 to DN 200.

System design and performance

Planning, installation and commissioning are to comply with AS/NZS 3500.2 and REHAU drainage system RAUPIANO PLUS – Technical information.

System component – RAUPIANO PLUS pipe

Pipe materials shall be composite polypropylene, consisting of polypropylene inner layer, mineral-filled polypropylene middle layer and UV-stabilised polypropylene outer layer, complying with AS/NZS 7671 for gravity drainage and stormwater drainage system in residential and commercial applications.

The pipes shall be designed for an operating temperature of 90°C and can temporarily withstand temperatures of up to 95°C and marked with ice crystal to indicated suitability for installations under extreme low temperatures up to -10°C. The pipes shall have excellent chemical resistance, withstanding acidity level from pH 2 - 12.

The packing of the pipe materials shall be done to reduce UV-radiation effect to the pipe materials themselves and to protect the pipe materials from dirt and other foreign materials.

System component - RAUPIANO PLUS fitting

Fitting materials shall be mineral-filled polypropylene for acoustic performance enhancement, complying with AS/NZS 7671 for gravity drainage and stormwater drainage system in residential and commercial applications.

The fittings shall be designed for a temperature of 90°C and can temporarily withstand temperatures of up to 95°C and suitable for installations under extreme low temperatures up to -10°C. The fittings shall have excellent chemical resistance, withstanding acidity level from pH 2 - 12.

The packing of the fittings shall be done to reduce UV-radiation effect to the pipe materials themselves and to protect the pipe materials from dirt and other foreign materials.

System component - RAUPIANO PLUS sound-dampening bracket

Sound-dampening bracket shall be rubber-lined with vibration-decoupling system to reduce the structure-borne noise transmitted from the DWV system.

Connections

The connections between the polypropylene pipes and fittings shall be of leak-proof push-fit socket connection with SBR sealing ring. The connections shall be able to withstand internal pressure of up to 100 kPa and accommodate thermal expansion.

Fire behaviour

The pipes and fittings shall correspond to the requirements of normally combustible building materials (class DIN 4102-B2) in keeping with DIN 4102-1 and D-S3,d0 in keeping with EN 1350.1. Please refer to RAUPIANO PLUS – the versatile acoustic drainage system - Technical information for notes on Fire Protection.

Acoustic behaviour

System acoustic performance shall have been demonstrated to meet the BCA/NCC requirements for Sound Transmission and Insulation (BCA/NCC Volume 1 Part F5), F5.6 - Sound insulation rating of services when tested to ISO 140 methodology and sound insulation performance rated according to ISO 717.

When rated in accordance to ISO 717 the system shall meet or exceed the BCA/NCC requirements of $R_w+C_{tr} = 25$ when adjacent to non-habitable areas, and $R_w+C_{tr} = 40$ when adjacent to habitable rooms, without the use of acoustic lagging material, and with the only following additional construction:

- 75mm R1.5 glass wool acoustic insulation batts
- 13mm standard plasterboard

6.1 Shortening and tapering pipes



Fittings may not be shortened.

1. If necessary, shorten the pipes with common pipe cutters or a fine-toothed saw.
2. Make a cut at 90° angle from the pipe axis.
3. De-burr the inner diameter of the pipe.
4. For connections to push-fit socket pipe systems, taper the pipe ends with a tapering tool or a coarse file at an angle of approximately 15°.



CAUTION

Danger of damage to property!

At low temperatures, the mineral-reinforced pipe material RAU-PP becomes brittle and thus more sensitive to impacts, like every other material.

The optimised material consistency of RAUPIANO PLUS is characterised by excellent impact strength at cold temperature. RAUPIANO PLUS is marked with the ice crystal in accordance with AS/NZS 7671 and DIN EN 1411 to indicate this.

6.2 Joining fittings and pipes

1. Clean dirt from sealing ring, sleeve interior and pipe end.
2. Coat spigot end with REHAU lubricant and slide into the sleeve until it stops.
3. Mark inserted spigot end in this position at the sleeve edge with a pencil, pen etc.
4. With longer pipes (> 500 mm), pull the spigot end out an additional 10 mm from the sleeve to create an expansion joint for heat-related expansion.
5. With short pipes (≤ 500 mm) and fittings, insert the spigot ends fully into the sleeves.

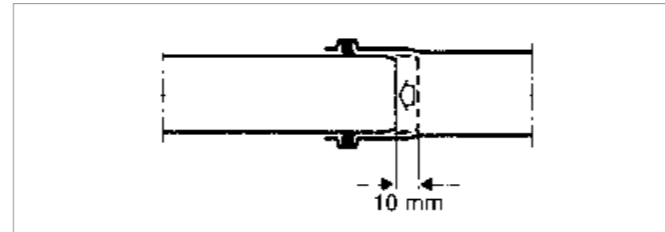


Fig. 6-1 Pulling out pipe ends for expansion joints.



By pulling out the spigot ends from the sleeves, the changes in length of the pipe caused by temperature fluctuations are absorbed in the push-fit sockets.

Each RAUPIANO PLUS pipe sleeve can accept the changes in length of a waste pipe up to 3 m in length (coefficient of linear expansion in accordance with DIN 53752 averages 0.09 mm/(m·K) at 0°C to 70°C).

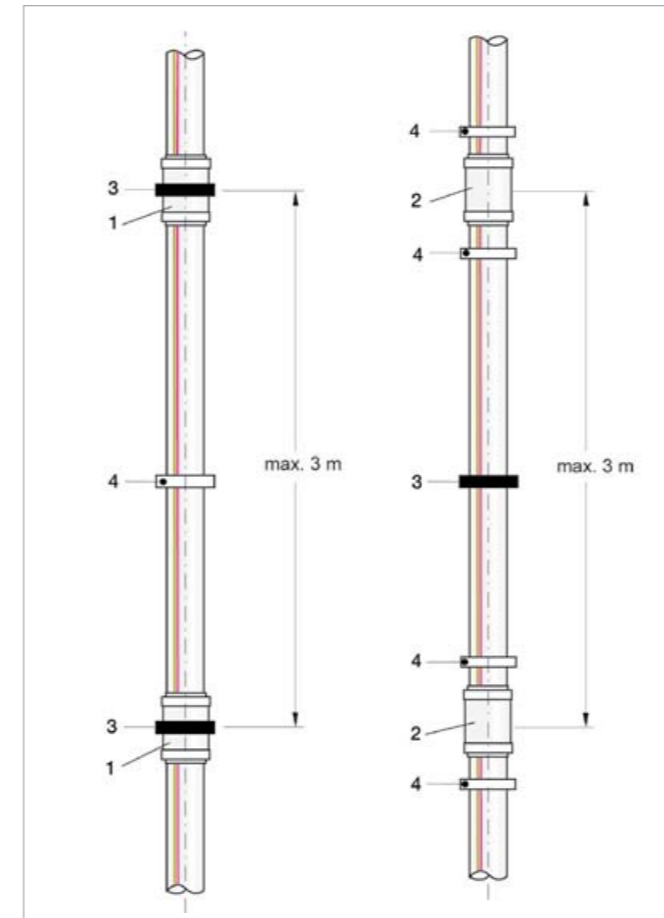


Fig. 6-2 Using double sockets and sleeve couplers.

- | | |
|------------------|-----------------|
| 1 Double socket | 3 Fixing clamp |
| 2 Sleeve coupler | 4 Guiding clamp |

6.3 Handling cut lengths and remaining lengths

Cut lengths and remaining lengths (pipes with smooth ends) can be handled with double sockets and sleeve couplers up to a maximum pipe length of 3 m. Ensure that sufficient expansion joints are present in the pipe sleeves here as well.

6.4 Installation of additional fittings

The installation of additional fittings in an existing pipeline is possible with sleeve couplers:

1. Cut out a sufficiently long section of pipe from the pipeline: fitting length + 2 x pipe outer diameter
2. De-burr pipe ends.
3. Slide sleeve coupler all the way onto one end of the pipe.
4. Slide fitting onto the other end of the pipe.
5. Fit adapter into the remaining space of the pipe and de-burr.
6. Slide second sleeve coupler all the way onto the adapter.
7. Insert adapter and close both gaps by sliding the sleeve couplers. Use REHAU lubricant liberally here.

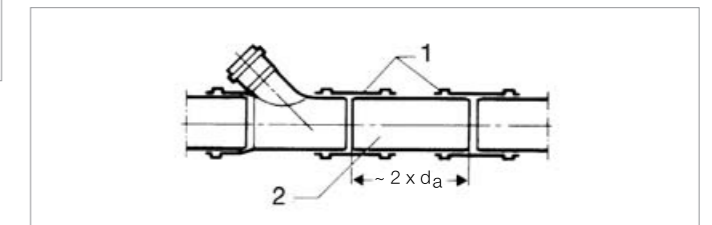


Fig. 6-3 Installing fitting.

- | | |
|------------------|---------------------------|
| 1 Sleeve coupler | d_a Pipe outer diameter |
| 2 Adapter | |

6.5 Connecting drain fitting

There are three options for connecting plumbing fixture drainage fittings (e.g. air traps) to RAUPIANO PLUS drainage pipes or fittings:

- RAUPIANO PLUS connection pipe
- RAUPIANO PLUS connection bend
- RAUPIANO PLUS fitting with beaded rubber nipple

RAUPIANO PLUS connection pipe

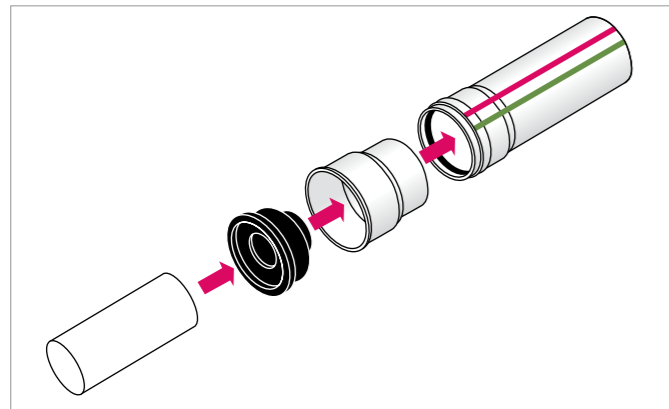


Fig. 6-4 RAUPIANO PLUS connection pipe with rubber nipple.

1. Insert rubber nipple in the socket of the connection pipe.
2. Apply REHAU lubricant on the sealing lips of the rubber nipple.
3. Insert nozzle of drain fitting of plumbing fixture into the rubber nipple.

RAUPIANO PLUS connection bend

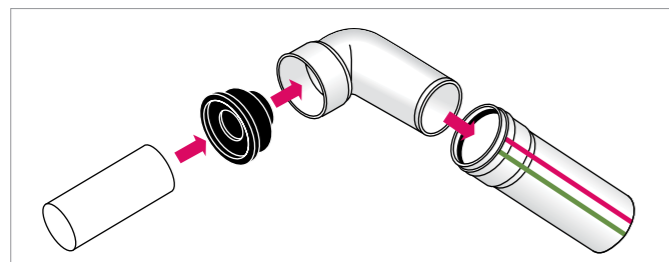


Fig. 6-5 RAUPIANO PLUS connection bend with rubber nipple.

1. Insert rubber nipple in the socket of the connection bend.
2. Apply REHAU lubricant on the sealing lips of the rubber nipple.
3. Insert nozzle of the drain fitting of plumbing fixture into the rubber nipple.

RAUPIANO PLUS fitting with beaded rubber nipple

1. Remove the installed sealing rubber from the pipe or fitting socket.
2. Insert rubber nipple with bead into the fitting socket.
3. Insert nozzle of the drain fitting of plumbing fixture into the rubber nipple.

6.6 Rubber sleeve adaptor for Cast Iron pipe or other materials



Fig. 6-6 Rubber sleeve for same outer diameters DN110/DN110.



Fig. 6-7 Rubber sleeve for different outer diameters DN110/DN 90.

For transition from RAUPIANO PLUS pipes to Cast Iron pipes or other materials for drainage systems, rubber sleeve adaptors can be used. These rubber sleeves come with rubber seal that is attached to the pipe ends and two stainless-steel worm-gear clamps. These rubber sleeve adaptors can be used in new construction or renovation works.

Below are the properties of the rubber sleeve adaptor.

| | |
|-------------------------------|----------------------------------|
| Material | Rubber |
| Tightening device | Stainless-steel worm-gear clamps |
| Recommended tightening torque | 3 Nm |
| Pressure resistance | 1 bar |
| Chemical resistance | pH 2 - 12 |

Table 6-1 Properties of rubber sleeve adaptor.

Installation steps:

1. Insert RAUPIANO PLUS pipe end into one end of the rubber sleeve adaptor.
2. Insert Cast Iron / other material pipe end into the other end of the rubber sleeve adaptor.
3. Tighten the worm-gear clamps on both ends of the rubber sleeve adaptor without exceeding the maximum tightening torque.

The rubber sleeve adaptor can be installed on most Cast Iron and other materials pipe sizes, the table below specifies the suitable dimensions of Cast Iron or other pipe materials.

| Article No. | Description | RAUPIANO PLUS OD Size | OD of other pipe material |
|-------------|-------------|-----------------------|---------------------------|
| 125024-001 | 50/53-63 | 50 | 53 - 63 |
| 125034-001 | 75/75-89 | 75 | 75 - 89 |
| 123904-001 | 110/90 | 110 | 75 - 89 |
| 123914-001 | 110/110 | 110 | 100 - 115 |

Table 6-2 Suitable sizes for rubber sleeve adaptor.

6.7 Adapting to PVC system

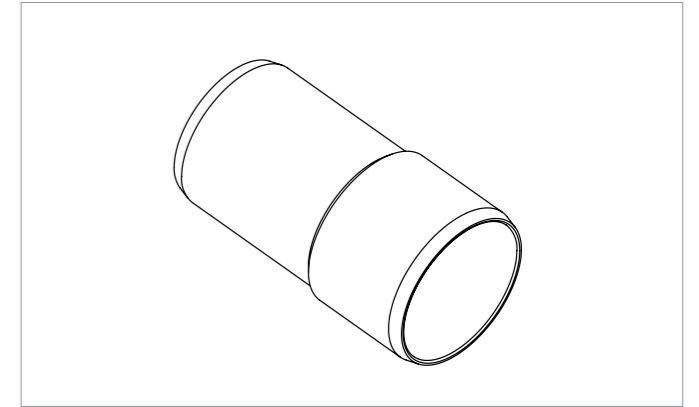


Fig. 6-8 Adaptor fitting from RAUPIANO PLUS to PVC system.

If it is necessary to adapt to PVC systems which are manufactured according to AS/NZS 1260, the simple adaptor from RAUPIANO PLUS to PVC system is available. To install these adaptors, please follow the following steps:

- apply primer and solvent cement on the correct part of the adaptor
- insert the solvent-cemented portion into a female socket of PVC fitting
- apply REHAU lubricant to the other portion of the adaptor and insert it to RAUPIANO PLUS socket

These adaptors are made of PVC and available for the following sizes:

| PVC adaptor | From | | To | |
|-------------|---------------|---------|------------|---------|
| | RAUPIANO PLUS | OD (mm) | PVC system | OD (mm) |
| DN 40/43 | DN 40 | 40 | DN 40 | 43 |
| DN 50/56 | DN 50 | 50 | DN 50 | 56 |
| DN 75/69 | DN 75 | 75 | DN 65 | 69 |
| DN 90/82 | DN 90 | 90 | DN 80 | 82 |

Table 6-3 Available adaptor sizes from RAUPIANO PLUS to PVC system.



It is not necessary to adapt from RAUPIANO PLUS DN 110 to PVC system DN 100 as they have exactly the same outer diameter of 110 mm. It is possible to insert DN 100 PVC pipe into DN 110 RAUPIANO PLUS socket after applying REHAU lubricant.

6.8 Cleaning the waste pipe system



Fig. 6-9 RAUPIANO PLUS I.O. access pipe.

Installing access pipes enables mechanical cleaning of the waste pipe system.

RAUPIANO PLUS access pipe is supplied with insert to ensure flushing surface for smooth and uninterrupted water flow.

Place the insert into the access opening and tighten the screw cap with rubber seal inserted.



Do not use sharp cleaning devices for mechanical cleaning.

6.9 Socket plug



Fig. 6-10 RAUPIANO PLUS socket plug.

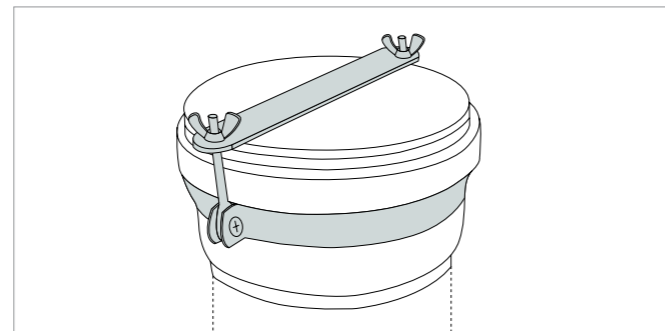


Fig. 6-11 RAUPIANO PLUS securing clip.

The socket plug can be used to plug-off the pipe ends if they are not in use. The socket plug is to be used together with the securing clip to ensure a safe and tight jointing.

6.10 P-trap siphon

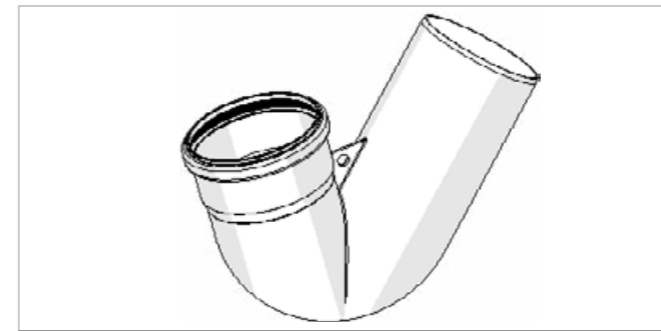


Fig. 6-12 RAUPIANO PLUS P-trap siphon

RAUPIANO PLUS P-trap siphon provides 50 mm water seal to prevent foul odour from coming out of the drainage lines. The P-trap siphon is to be used together with DN 110 bend 45°.

When installing this P-trap, it is important to install the pipe support properly to ensure safe operation of the drainage system.



The P-trap siphon can be supported by attaching a hook into the built-in hole.

6.11 Installing pipes in installation shafts

The RAUPIANO PLUS waste pipes and fittings can be installed in installation shafts without additional structure-borne noise insulation. Heating and condensation-water insulations are only required in special cases (e.g. inlying roof drainage).

Construct wall and ceiling penetrations with common moisture-protected structure-borne noise insulations to acoustically decouple the pipelines.

6.12 Installing pipes in masonry



Observe the applicable national regulations for recesses and slots in the masonry.

- Make wall slots in such a way that the pipeline can be laid without tension.
- Avoid sound bridges between the masonry and the pipe.

If the pipes will be plastered directly without using a plaster board (e.g. brick rabbit, expanded metal baffle) or cladding:

- Cover pipes and fittings on all sides with flexible materials such as mineral or glass wool or commercial insulation tubes beforehand.
- If using plaster boards, close the slot beforehand with mineral wool, for example. This prevents sound bridges from forming between the pipe and masonry when applying the plaster.
- Protect pipes and fittings from the effects of high temperatures with appropriate measures for heating insulation at points at which temperatures over 90°C are reached due to external influences.

6.13 Installing pipes in concrete



When installing in concrete, we recommend decoupling the pipelines from the main structure by using common moisture-protected structure-borne noise insulations with a thickness greater than 4 mm. A limitation of the sound-insulation effectiveness can be expected, however.

- Attach pipe components in such a way that a change in position during concrete application is prevented.
- Ensure sufficient expansion joints when installing the pipe.
- Seal off sleeve gap with adhesive strips to prevent the penetration of concrete.
- Seal off pipe openings before concrete application.



CAUTION

Danger of damage to property!

Damage to the pipelines!

- Avoid placing the weight of the concrete on the pipelines by making provisions for dissipating the load, e.g. by using:
 - Spacers in the case of reinforcing steels
 - Carrying boxes
 - Brackets
- Avoid walking on the pipes during concrete application.

6.14 Installation above suspended ceilings

Installation above suspended ceiling might require additional acoustic measures to ensure a high degree of sound insulation. The additional acoustic measures depend on a few factors:

- The room type directly underneath the piping (wet areas, bedroom or other habitable rooms)
- The construction type of the building
- The type of plasterboard used as suspended ceiling
- The expected water flow rate within the particular drainage line
- The desired acoustic level to be achieved

In general, it is unnecessary to take extra measures to sound-insulate RAUPIANO PLUS system when it is installed above wet areas and other habitable rooms, with water flow rate taken into consideration. But if a very high degree of acoustic requirement is specified for that particular room, it is necessary to wrap RAUPIANO PLUS system with sound insulation that passes above that room.

6.15 Ceiling penetrations

Ceiling penetrations must be constructed to be moisture-proof and sound-insulating. Fire-protection measurements may be necessary if pipes penetrate through fire-rated building elements. Refer to chapter 4 for details.

If mastic asphalt is to be applied to the floor:

Protect exposed pipeline components with ceiling liner, protective sleeves or by winding them with heat-insulating materials.

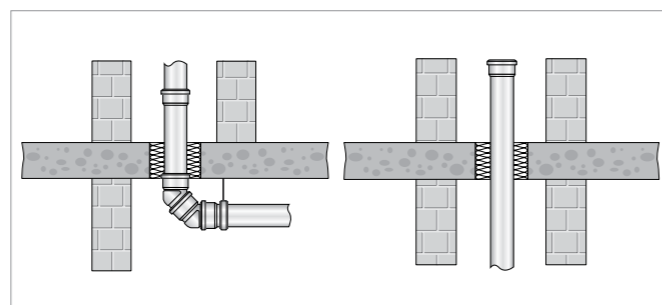


Fig. 6-13 Recommended ceiling penetration practices.

6.16 Installation as stormwater piping

There is a risk of dew formation on the pipes installed as stormwater piping within the building.

Condensation water appears when the temperature of the pipe walls drops below the dew point temperature of the ambient air due to cold rain water, for example. Humidity from the ambient air then condenses on the pipe surface.

For this reason, all pipelines in the building on which condensation water could form are to be provided with diffusion-proof insulation material. Insulation of the collecting pipes in the cellar can be dispensed with if there is no risk of dew formation. In general, this is the case with exposed stormwater piping in unheated cellars if temperature equalisation occurs.

Condensation-water insulation materials

Closed-cell materials with high water vapour diffusion resistance are recommended for use as condensation-water insulation. If open-cell or fibrous insulation materials are used, they must have an impermeable outer layer that is firmly attached to the insulation material.

- Close off all impact, groove, cut and end points of the insulation with a permanent seal.
- Cut out insulation in the bracket area.
- Pull insulation material over the bracketed section and permanently seal it to the neighbouring insulation material with adhesive.

Fixing of stormwater piping

To prevent the pipelines from sliding apart, a security clamp is to be attached to the pipe directly below the supporting clamp.

To achieve optimum sound insulation, use only RAUPIANO PLUS sound dampening brackets during assembly.

RAUPIANO PLUS drainage pipes must be installed tension-free.

7.1 Support bracket for vertical stack

The patented sound-dampening support bracket consists of a supporting clamp and a fastening clamp. In general, one sound-dampening support bracket per storey is sufficient.

1. Fit fastening clamp around the pipe and close it.
2. Assemble supporting clamp on masonry.



Fig. 7-1 Supporting clamp assembled, opened.



A spacer is attached at the closure of the support clamp to prevent the clamp being closed completely. This ensures minimum transmission of structure-borne noise to the wall.

3. Open supporting clamp, insert pipe with fastening clamp and close supporting clamp.



Fig. 7-2 Closing supporting clamp.

After installation, the fastening clamp fully lies on the supporting clamp. This achieves optimum sound decoupling.



Fig. 7-3 Fully installed support bracket.

7.2 Fixing plan for vertical stack

A plan for effective bracketing of a sound-insulating vertical stack with RAUPIANO PLUS is displayed graphically (see Fig. 7-4).



Every site is different; the installation practice described below might not be applicable all the time.

Transition to the collecting pipe (commonly at basement level)

1. Create a flow redirection from vertical stack into the collecting pipe by installing two 45° bends together with a short pipe in between (RAUPIANO PLUS pipe 250 mm).
2. To minimize the distance from the ceiling to collecting pipe, embed the socket of the first 45° bend (upper) in the ceiling area.
3. Use a fire collar if necessary.

Storey above the collecting pipe (from bottom to top)

1. Install RAUPIANO PLUS pipe just above the first 45° bend.
2. Install a branch after the vertical pipe.
3. Attach sound-dampening bracket directly below the socket of the vertical pipe.
4. Install a guiding bracket below the sound-dampening bracket with a distance of approximately 2/3 of the vertical pipe.



- Although it is a good practice to install the sound-dampening bracket directly below the pipe socket, it is not necessary to do so.
- The guiding bracket permits free longitudinal movement of RAUPIANO PLUS pipe.

Following above storeys (from bottom to top)

1. Install another RAUPIANO PLUS pipe after the branch of the lower storey to penetrate the slab, use fire collar if necessary.
2. Install a branch after the vertical pipe.
3. Attach sound-dampening bracket directly below the socket of the vertical pipe.
4. Install a guiding bracket below the sound-dampening bracket with a distance of approximately 2/3 of the vertical pipe.



If there are short pipes (≤ 500 mm) installed within the vertical stack pipe, no additional bracketing is necessary.

Additional securing bracket

- To prevent the vertical stack pipes from sliding apart, additional security bracket should be installed directly below the sound-dampening bracket:
- For single dwellings, only on the first storey.
 - For multi-storey apartment buildings, on every third storey.

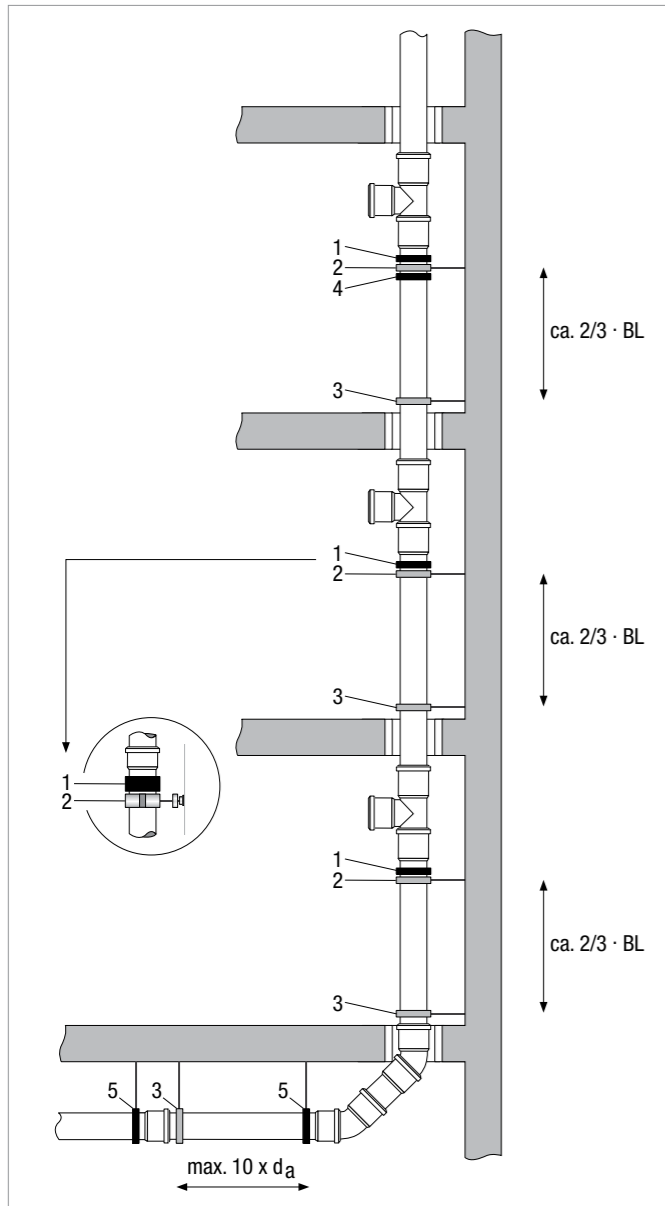


Fig. 7-4 Installation plan for vertical stack.

- 1 Fastening clamp (upper part of sound-dampening bracket)
- 2 Supporting clamp (bottom part of sound-dampening bracket)
- 3 Guiding bracket (loose)
- 4 Fixing/security bracket (tight)
- 5 Fixing/security bracket (tight)
- BL Pipe length
- d_a Pipe outer diameter

7.3 Bracketing plan for horizontal pipes

A plan for effective bracketing of a horizontal sound-insulating pipe with RAUPIANO PLUS is displayed graphically (see Fig. 7-5).



Sound-dampening support brackets are not necessary for a horizontal pipe.

- For short horizontal pipes (length $\leq 10 \times$ pipe outer diameter), assemble fixing clamp directly next to the pipe socket.
- For longer horizontal pipes (length $> 10 \times$ pipe outer diameter), assemble additional guiding clamps:
 - The distance between the fixing clamp and the guiding clamps may not exceed ten times the pipe outer diameter d_a (see Fig. 7-5): Spacing $\leq 10 \times d_a$.

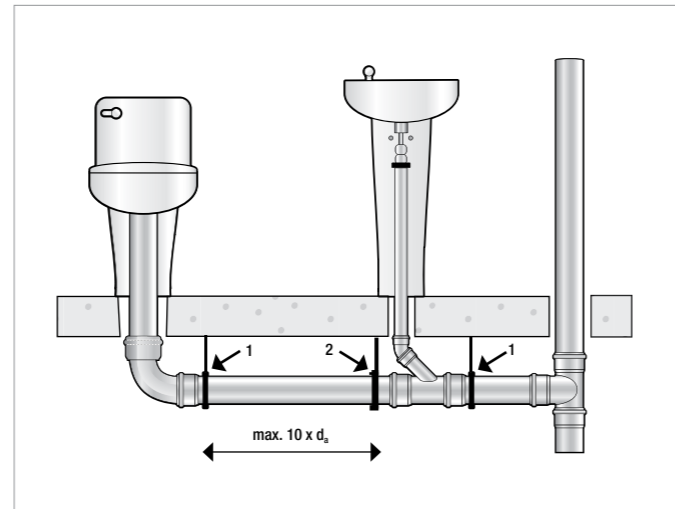


Fig. 7-5 Installation plan for horizontal pipeline.

- 1 Fixing bracket
- 2 Guiding bracket
- d_a Pipe outer diameter

7.4 Short pipes and fittings

- If pipe sections with fittings or short pipes are formed:
- Prevent the pipe components from sliding apart with fixing brackets.
 - Secure socket plug from being pushed out by installing securing clip.

RAUPIANO PLUS was approved by the following certification agencies and others:



Germany



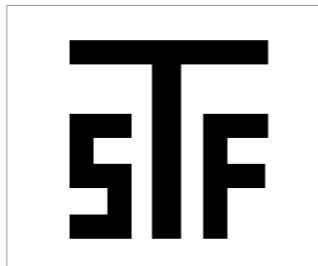
Germany



Sweden



Norway



Finland



Russia



Denmark



Denmark



Poland



Austria



Hungary



Malaysia



Australia

RAUPIANO PLUS

TECHNICAL SPECIFICATIONS

| | | |
|---|---|--|
| Material | PP-MD mineral-reinforced (pipes and fittings) | |
| Size range | DN 40 – DN 200 | |
| Area of application | Drainage pipes in buildings and above ground installation | |
| Chemical resistance | Polypropylene basis No waste water containing benzene Seals made of SBR | in accordance with DIN 8078 DIN 4060, DIN EN 681-1 |
| Application | Waste water with pH value 2 – 12 Waste water temperature up to 95°C (brief periods) or 90°C (continuous load) | |
| Density | Pipes 1.9 g/cm ³ Fittings 1.1 – 1.9 g/cm ³ | |
| Coefficient of thermal expansion | 0.09 mm/m·K | DIN 53752 |
| Ring stiffness | > 4 kN/m ² | DIN EN ISO 9969 |
| Tensile strength | > 16 N/mm ² | DIN EN ISO 527-3 |
| Elongation before breaking | Approx. 150 % | DIN EN ISO 527-3 |
| Modulus of elasticity | Approx. 2,700 N/mm ² | DIN EN ISO 527-2 |
| MFR 190/5 | Approx. 1.7 g/10 min. | DIN EN ISO 1133 |
| MFR 230/2,16 | Approx. 0,82 g/10 min. | DIN EN ISO 1133 |
| Pressure resistance | 1 bar (10 m water column) | |
| Pipe structure | Pipes features innovative three-layer structure - Impact-resistant and shock-proof PP outer layer - Highly rigid middle layer made of mineral-reinforced PP - Abrasion-resistant and very slick inner layer Fittings - Mass optimisation in redirection area for increased sound insulation DN 90 – DN 160 | |
| Halogen contents | Halogen-free (no F, Cl, Br, J) | |
| Connection | Push-fit socket with factory-installed lip sealing ring | |
| Fire behaviour | B2 (normally inflammable) D,S3-d0 | In accordance with DIN 4102 In accordance with EN 13501-1 |
| System compatibility | No adapters for HT or KG pipes required, adapters to Cast Iron and PVC system are available | |
| Standards and approval | System test according to AS/NZS 7671 Watermark WM 70060 | |
| Sound insulation | Tested to ISO 140 methodology. Sound insulation performance rated according to ISO 717. Fulfil BCA/NCC requirement of Rw + Ctr 40 for habitable rooms without acoustic lagging. | |
| Independent monitoring | Süddeutsches Kunststoffzentrum (SKZ), Germany | |
| Fire load | The RAUPIANO PLUS fire load was determined by MPA. It is - 14,992 kJ/kg Transferred to a DN 110 RAUPIANO PLUS pipe: - 7.9 kWh/m - 28,464.8 kJ/m | |

Tab. 9-1 Technical specifications.

9.

RAUPIANO PLUS

CHEMICAL RESISTANCE

Pipe and fitting

The specifications are used for the initial orientation of the chemical resistance of the material (not of the possible influence of the corrosive agent) and cannot simply be applied to all usage scenarios. Mechanical behaviour can be impaired in cases where tension and the presence of chemicals occur simultaneously (tension-fracture corrosion).

| Reagent | Concentr. % | Temp. °C | RAUPP |
|----------------------------|-------------|----------|-------|
| 2-Propen-1-ol | 96 | 20 | r |
| | 96 | 60 | r |
| Acetaldehyde + acetic acid | 90/10 | 20 | – |
| Acetaldehyde, aqueous | 40 | 40 | r |
| Acetaldehyde, concentrated | 100 | 20 | – |
| Acetate ether | 100 | 20 | – |
| Acetic acid, aqueous | up to 25 | 40 | r |
| | up to 25 | 60 | r |
| | 25–60 | 60 | r |
| | 80 | 40 | r |
| Acetic acid, concentrated | 95 | 40 | – |
| Acetic anhydride | 100 | 20 | r |
| | 100 | 40 | cr |
| | 100 | 60 | cr |
| Acetone | 100 | 20 | r |
| | 100 | 60 | r |
| Acetone, aqueous | traces | 20 | r |
| Acronal dispersions | com. avail. | 20 | – |
| Acronal solutions | com. avail. | 20 | – |
| Acrylic acid ethyl ester | 100 | 20 | – |
| Adipic acid, aqueous | saturated | 20 | r |
| | saturated | 60 | – |
| Aluminium chloride | diluted | 40 | r |
| | diluted | 60 | r |
| | saturated | 60 | r |

Rubber sealing ring

The types of rubber used generally exhibit quite good chemical resistance, but components of esters, ketones and aromatic and chlorinated hydrocarbons in sewer water expand heavily, which can lead to damage of the connection.

If in doubt, we recommend testing the suitability of the pipe, fitting and seal material in existing systems or have them checked in a laboratory. Contact our applications department if necessary.

Table legend

r = resistant
cr = conditionally resistant
nr = not resistant
– = not tested

| Reagent | Concentr. % | Temp. °C | RAUPP |
|--------------------------------|-------------|----------|-------|
| Aluminium sulfate, aqueous | diluted | 40 | r |
| | diluted | 60 | r |
| | saturated | 60 | r |
| Alums, aqueous | diluted | 40 | r |
| | diluted | 60 | r |
| | saturated | 60 | r |
| Ammonia, gas | 100 | 60 | r |
| Ammonia, liquid | 100 | 20 | r |
| Ammonium chloride, aqueous | diluted | 40 | r |
| | diluted | 60 | r |
| | saturated | 60 | r |
| Ammonium fluoride, aqueous | up to 20 | 20 | r |
| | up to 20 | 60 | r |
| Ammonium hydroxide | warm sat. | 40 | r |
| | warm sat. | 60 | r |
| Ammonium nitrate, aqueous | diluted | 40 | r |
| | diluted | 60 | r |
| | saturated | 60 | r |
| Ammonium sulfate, aqueous | diluted | 40 | r |
| | diluted | 60 | r |
| | saturated | 60 | r |
| Ammonium sulfide, aqueous | diluted | 40 | r |
| | diluted | 60 | r |
| | saturated | 60 | r |
| Aniline hydrochloride, aqueous | saturated | 20 | r |
| | saturated | 60 | r |

| Reagent | Concentr. % | Temp. °C | RAUPP | Reagent | Concentr. % | Temp. °C | RAUPP |
|---|---------------|----------|-------|----------------------------------|-------------|----------|-------|
| Aniline, aqueous | saturated | 20 | r | Butylene, liquid | 100 | 20 | – |
| | saturated | 60 | r | Butylphenol | 100 | 20 | r |
| Aniline, pure | 100 | 20 | r | Butynediol | up to 100 | 40 | – |
| | 100 | 60 | r | Butyric acid, aqueous | 20 | 20 | r |
| Animal glue | custom. conc. | 20 | r | | concentr. | 20 | r |
| | custom. conc. | 60 | r | Calcium chloride, aqueous | diluted | 40 | r |
| Anthraquinonesulfonic acid, aqueous | suspension | 30 | r | | diluted | 60 | r |
| Antiformin, aqueous | 2 | 20 | – | | saturated | 60 | r |
| Antimony chloride, aqueous | 90 | 20 | r | Calcium nitrate, aqueous | 50 | 40 | r |
| Arsenic acid, aqueous | diluted | 40 | r | Carbolineum, aqueous | usage conc. | 20 | – |
| | diluted | 60 | r | Carbon dioxide, aqueous under | saturated | 20 | – |
| | 80 | 40 | r | 8 atmospheric pressures | | | |
| | 80 | 60 | r | Carbon dioxide, dry | 100 | 60 | r |
| Beef tallow emulsion, sulphonated | com. avail. | 20 | – | Carbon dioxide, moist | any | 40 | r |
| Beer | com. avail. | 20 | r | | any | 60 | r |
| Beer colouring agent | com. avail. | 60 | r | Carbon disulfide | 100 | 20 | cr |
| Benzaldehyde, aqueous | 0,1 | 60 | – | Carbon tetrachloride, technical | 100 | 20 | nr |
| Benzene | 100 | 20 | cr | Caustic potash solution, aqueous | up to 40 | 40 | r |
| Benzoic acid, aqueous | any | 20 | r | | up to 40 | 60 | r |
| | any | 40 | r | | 50/60 | 60 | r |
| | any | 60 | r | Caustic soda, aqueous | up to 40 | 40 | r |
| Bisulphite solution, w/ SO ₂ | warm sat. | 50 | r | | up to 40 | 60 | r |
| Bleaching liquor, containing 12.5 % active chlorine | usage conc. | 40 | – | | 50/60 | 60 | r |
| | usage conc. | 60 | cr | Chloramine, aqueous | diluted | 20 | – |
| Borax, aqueous | diluted | 40 | r | Chloric acid, aqueous | 1 | 40 | – |
| | diluted | 60 | r | | 1 | 60 | – |
| | saturated | 60 | r | | 10 | 40 | – |
| Boric acid, aqueous | diluted | 40 | r | | 10 | 60 | – |
| | diluted | 60 | r | | 20 | 40 | – |
| | saturated | 60 | r | | 20 | 60 | – |
| Brandy | com. avail. | 20 | r | Chlorine water | saturated | 20 | cr |
| Bromine fumes | minimal | 20 | nr | Chlorine, gaseous, dry | 100 | 20 | nr |
| Bromine, liquid | 100 | 20 | nr | Chlorine, gaseous, moist | 0,5 | 20 | nr |
| Butadiene | 100 | 60 | – | | 1 | 20 | nr |
| Butane, gaseous | 50 | 20 | r | | 5 | 20 | nr |
| Butanediol | up to 100 | 20 | – | Chlormethyl | 100 | 20 | – |
| Butanediol, aqueous | up to 10 | 20 | r | Chloroacetic acid (mono) | 100 | 40 | r |
| | up to 10 | 40 | r | | 100 | 60 | – |
| | up to 10 | 60 | r | Chloroacetic acid (mono) aqueous | 85 | 20 | r |
| Butanol | up to 100 | 20 | r | Chlorosulfonic acid | 100 | 20 | nr |
| | up to 100 | 40 | r | Chromic acid, aqueous | up to 50 | 40 | – |
| | up to 100 | 60 | cr | | up to 50 | 60 | cr |
| Butyl acetate | 100 | 20 | cr | | | | |

| Reagent | Concentr. % | Temp. °C | RAUPP | Reagent | Concentr. % | Temp. °C | RAUPP |
|--|-------------|----------|-------|--|---------------|----------|-------|
| Chromic acid/Sulphuric acid/Water | 50/15/35 | 40 | nr | Ethylene oxide, liquid | 100 | 20 | – |
| | 50/15/35 | 60 | nr | Exhaust gas, w/ H ₂ CO ₃ | any | 60 | r |
| Cider | com. avail. | 20 | r | Exhaust gas, w/ HF | traces | 60 | r |
| Citric acid, aqueous | up to 10 | 40 | r | Exhaust gas, w/ NOX | traces | 60 | r |
| | up to 10 | 60 | r | | higher | 60 | – |
| | saturated | 60 | r | Exhaust gases, w/ H ₂ S ₂ O ₇ | lower | 20 | – |
| Clophene | com. avail. | 20 | – | | higher | 20 | nr |
| | com. avail. | 60 | – | Exhaust gases, w/ H ₂ SO ₄ , moist | any | 60 | r |
| Coconut fat alcohol | 100 | 20 | r | Exhaust gases, w/ HCl | any | 60 | r |
| | 100 | 60 | cr | Exhaust gases, w/ SO ₂ | lower | 60 | r |
| Copper fluoride, aqueous | 2 | 50 | r | | 50 | 50 | – |
| Copper sulfate, aqueous | diluted | 40 | r | Fatty acids | 100 | 60 | cr |
| | diluted | 60 | r | Ferric chloride, aqueous | up to 10 | 40 | r |
| | saturated | 60 | r | | up to 10 | 60 | r |
| Cresol, aqueous | up to 90 | 45 | – | | saturated | 60 | r |
| Crotonaldehyde | 100 | 20 | r | Fertilizer salts, aqueous | up to 10 | 40 | r |
| Cyclohexanol | 100 | 20 | r | | up to 10 | 60 | r |
| Cyclohexanone | 100 | 20 | r | | saturated | 60 | r |
| Cyclohexanone | 100 | 20 | r | Fluorsilicic acid, aqueous | up to 32 | 60 | – |
| Densodrin W | com. avail. | 60 | – | Formaldehyde, aqueous | diluted | 40 | r |
| Dextrin, aqueous | saturated | 20 | r | | diluted | 60 | r |
| | 18 | 60 | r | | 40 | 30 | r |
| Dextrose, aqueous | saturated | 20 | b | Formic acid | 100 | 20 | r |
| | saturated | 60 | b | | 100 | 60 | cr |
| Diethylether | 100 | 20 | cr | Formic acid, aqueous | up to 50 | 40 | r |
| Diglycol acid, aqueous | 30 | 60 | r | | 50 | 60 | r |
| | saturated | 20 | r | Frigen | 100 | 20 | cr |
| Dimethyl sulfate, aqueous | up to 50 | 20 | r | Fruit pulp | custom. conc. | 20 | r |
| | up to 50 | 40 | r | Glucose, aqueous | saturated | 20 | r |
| | 100 | 40 | – | | saturated | 60 | r |
| | 100 | 60 | – | Glycerine, aqueous | any | 60 | r |
| Dimethylamine, liquid | 100 | 30 | – | Glycine, aqueous | 10 | 40 | r |
| Disulfuric acid | 10 | 20 | nr | Glycol, aqueous | com. avail. | 60 | r |
| Ethanol (fermentation mash) | common | 40 | r | Glycolic acid, aqueous | 37 | 20 | r |
| | common | 60 | – | Hexantriol | com. avail. | 60 | r |
| Ethanol, aqueous | any | 20 | r | Hydrobromic acid, aqueous | up to 10 | 40 | r |
| | 96 | 60 | r | | up to 10 | 60 | r |
| Ethanol, denatured (with 2 % toluene) | 96 | 20 | cr | | 48 | 60 | r |
| Ethanol+ acetic acid (fermentation mash) | common | 20 | r | Hydrochloric acid, aqueous | up to 30 | 40 | r |
| Ethyl acetate | 100 | 20 | cr | | up to 30 | 60 | r |
| | 100 | 60 | nr | | over 30 | 20 | r |
| Ethylene chloride | 100 | 20 | nr | | over 30 | 60 | r |

| Reagent | Concentr. % | Temp. °C | RAUPP | Reagent | Concentr. % | Temp. °C | RAUPP |
|--------------------------------|---------------|----------|-------|---|---------------|----------|-------|
| Hydrofluoric acid, aqueous | up to 40 | 20 | r | Mixed acid (Sulfuric acid/Nitric acid/Water) | 48/49/3 | 20 | nr |
| | 40 | 60 | r | | 48/49/3 | 40 | nr |
| | 60 | 20 | r | | 50/50/0 | 20 | nr |
| | 70 | 20 | r | | 50/50/0 | 40 | nr |
| Hydrogen | 100 | 60 | r | | 10/20/70 | 50 | cr |
| Hydrogen peroxide, aqueous | up to 30 | 20 | r | | 10/87/3 | 20 | nr |
| | up to 20 | 50 | r | 50/31/19 | 30 | nr | |
| Hydrogen phosphide | 100 | 20 | – | Molasses | custom. conc. | 20 | r |
| Hydrogen sulfide, dry | 100 | 60 | r | | custom. conc. | 60 | r |
| Hydrogen sulfide, aqueous | warm sat. | 40 | r | Molasses wort | custom. conc. | 60 | r |
| | warm sat. | 60 | r | Mowilith D | com. avail. | 20 | – |
| Hydrosulfite, aqueous | up to 10 | 40 | r | Nekal, BX, aqueous | diluted | 40 | – |
| | up to 10 | 60 | r | | diluted | 60 | – |
| Hydroxylamine sulfate, aqueous | up to 12 | 35 | r | Nickel sulfate, aqueous | diluted | 40 | r |
| Lactic acid, aqueous | up to 10 | 40 | r | | diluted | 60 | r |
| | up to 10 | 60 | r | | saturated | 60 | r |
| | 90 | 60 | r | Nicotine compounds, aqueous | usage conc. | 20 | – |
| Lead acetate, aqueous | warm sat. | 50 | r | Nicotine, aqueous | usage conc. | 20 | – |
| | diluted | 40 | r | Nitric acid, aqueous | up to 30 | 50 | r |
| | diluted | 60 | r | | 30/50 | 50 | nr |
| | saturated | 60 | r | | 98 | 20 | nr |
| Lead tetraethyl | 100 | 20 | r | | 98 | 60 | nr |
| Magnesium chloride, aqueous | diluted | 40 | r | Nitrous gasses | concentr. | 20 | r |
| | diluted | 60 | r | | concentr. | 60 | – |
| | saturated | 60 | r | Oils and greases | com. avail. | 60 | cr |
| Magnesium sulfate, aqueous | diluted | 40 | r | Oleic acid | com. avail. | 60 | cr |
| | diluted | 60 | r | Oleum vapour | lower | 20 | cr |
| | saturated | 60 | r | | higher | 20 | nr |
| Maleic acid, aqueous | saturated | 40 | r | Oxalic acid, aqueous | diluted | 40 | r |
| | saturated | 60 | r | | diluted | 60 | r |
| | 35 | 40 | r | | saturated | 60 | r |
| Malic acid, aqueous | 1 | 20 | r | Oxygen | any | 60 | – |
| Mersol D | custom. conc. | 40 | – | Ozone | 100 | 20 | cr |
| Methanol | 100 | 40 | r | | 10 | 30 | r |
| | 100 | 60 | r | Palm kernel oil acid | 100 | 60 | – |
| Methyl amine | 32 | 20 | r | Paraffin emulsions | com. avail. | 20 | – |
| Methylene chloride | 100 | 20 | nr | | com. avail. | 40 | – |
| Milk | com. avail. | 20 | r | Perchloric acid, aqueous | up to 10 | 40 | r |
| | | | | | up to 10 | 60 | r |
| | | | | | saturated | 60 | – |
| | | | | Petrol | 100 | 60 | nr |

| Reagent | Concentr. % | Temp. °C | RAUPP | Reagent | Concentr. % | Temp. °C | RAUPP |
|--|-------------|----------|-------|---------------------------------|--------------|----------|-------|
| Petrol-benzene mixture | 80/20 | 20 | cr | Potassium nitrate, aqueous | diluted | 40 | r |
| Phenol, aqueous | up to 90 | 45 | r | | diluted | 60 | r |
| | 1 | 20 | – | | saturated | 60 | r |
| Phenylhydrazine | 100 | 20 | cr | Potassium permanganate, aqueous | up to 6 | 20 | r |
| | 100 | 60 | – | | up to 6 | 40 | r |
| Phenylhydrazine hydrochloride, aqueous | saturated | 20 | – | | up to 6 | 60 | r |
| | saturated | 60 | – | | up to 18 | 40 | – |
| Phosgene, aqueous | 100 | 20 | nr | Potassium persulfate, aqueous | diluted | 40 | r |
| Phosgene, gaseous | 100 | 20 | cr | | diluted | 60 | r |
| | 100 | 60 | cr | | saturated | 40 | r |
| Phosphoric acid, aqueous | up to 30 | 40 | r | | saturated | 60 | r |
| | up to 30 | 60 | r | Propane, gaseous | 100 | 20 | – |
| | 40 | 60 | r | Propane, liquid | 100 | 20 | – |
| | 80 | 20 | r | Propargyl alcohol, aqueous | 7 | 60 | r |
| | 80 | 60 | r | Pure acetic acid | 100 | 20 | r |
| Phosphorous pentoxide | 100 | 20 | r | | 100 | 40 | r |
| Phosphorous trichloride | 100 | 20 | r | Ramasite | com. avail. | 20 | – |
| Photographic developers | com. avail. | 40 | r | | com. avail. | 40 | – |
| Photographic emulsions | any | 40 | – | Roaster gases, dry | any | 60 | r |
| Photographic fixers | com. avail. | 40 | r | Seawater | – | 40 | r |
| Picric acid, aqueous | 1 | 20 | r | | – | 60 | r |
| Potash, aqueous | saturated | 40 | – | Silicic acid, aqueous | any | 60 | r |
| Potassium borate, aqueous | 1 | 40 | r | Silver nitrate, aqueous | up to 8 | 40 | r |
| | 1 | 60 | r | | up to 8 | 60 | r |
| Potassium bromate, aqueous | up to 10 | 40 | r | Soap solution, aqueous | concentrated | 20 | r |
| | up to 10 | 60 | r | | concentrated | 60 | r |
| Potassium bromide, aqueous | diluted | 40 | r | Soda, aqueous | diluted | 40 | r |
| | diluted | 60 | r | | diluted | 60 | r |
| | saturated | 60 | r | | saturated | 60 | r |
| Potassium chlorate, aqueous | 1 | 40 | r | Sodium benzoate, aqueous | up to 10 | 40 | r |
| | 1 | 60 | r | | up to 10 | 60 | r |
| Potassium chloride, aqueous | diluted | 40 | r | | 36 | 60 | r |
| | diluted | 60 | r | Sodium chlorate, aqueous | up to 10 | 40 | r |
| | saturated | 60 | r | | up to 10 | 60 | r |
| Potassium chromate, aqueous | 40 | 20 | r | | saturated | 60 | r |
| Potassium cyanide, aqueous | up to 10 | 40 | r | Sodium chlorite, aqueous | 50 | 20 | r |
| | up to 10 | 60 | r | | diluted | 60 | nr |
| | saturated | 60 | r | Sodium hydrosulfite, aqueous | diluted | 40 | r |
| Potassium dichromate, aqueous | 40 | 20 | r | | diluted | 60 | r |
| Potassium ferrocyanide | diluted | 40 | r | | saturated | 60 | r |
| Potassium ferrocyanide, aqueous | diluted | 60 | r | Sodium hypochlorite, aqueous | diluted | 20 | r |
| | saturated | 60 | r | | | | |

RAUPIANO PLUS

STANDARDS, REGULATIONS AND GUIDELINES

| Reagent | Concentr. % | Temp. °C | RAUPP | Reagent | Concentr. % | Temp. °C | RAUPP |
|--|---------------|----------|------------------------|-----------------------------|---------------|----------|-------|
| Sodium sulfide, aqueous | diluted | 40 | r | Tartaric acid, aqueous | up to 10 | 40 | r |
| | diluted | 60 | r | | up to 10 | 60 | r |
| | saturated | 60 | r | | saturated | 60 | r |
| Spirits | com. avail. | 20 | r | Thionyl chloride | 100 | 20 | nr |
| Starch syrup | custom. conc. | 60 | r | Tin (II) chloride, aqueous | diluted | 40 | r |
| Starch, aqueous | any | 40 | r | diluted | 60 | r | |
| | any | 60 | r | saturated | 60 | r | |
| Stearic acid | 100 | 60 | cr | Toluene | 100 | 20 | nr |
| Sulphur dioxide, aqueous under 8 atmospheric pressures | saturated | 20 | – | Trichloroethylene | 100 | 20 | nr |
| Sulphur dioxide, liquid | 100 | –10 | – | Triethanolamine | 100 | 20 | r |
| | 100 | 20 | r | Trilone | com. avail. | 60 | – |
| | 100 | 60 | r | Trimethylolpropane, aqueous | up to 10 | 40 | – |
| Sulphur dioxide, moist and aqueous | any | 40 | r | up to 10 | 60 | – | |
| | 50 | 50 | r | com. avail. | 40 | r | |
| | any | 60 | r | com. avail. | 60 | r | |
| Sulphur dioxide, dry | any | 60 | r | Urea, aqueous | up to 10 | 40 | r |
| Sulphuric acid, aqueous | up to 40 | 40 | r | up to 10 | 60 | r | |
| | up to 40 | 60 | r | 33 | 60 | r | |
| | 70 | 20 | r | | | | |
| | 70 | 60 | cr | Urine | normal | 40 | r |
| | 80–90 | 40 | cr | normal | 60 | r | |
| | 96 | 20 | r | | | | |
| 96 | 60 | nr | Vinegar (wine vinegar) | com. avail. | 40 | r | |
| Table salt, aqueous | diluted | 40 | r | com. avail. | 50 | r | |
| | diluted | 60 | r | com. avail. | 60 | r | |
| | saturated | 60 | r | | | | |
| Tallow | 100 | 20 | r | Vinyl acetate | 100 | 20 | r |
| | 100 | 60 | r | Water | 100 | | r |
| | | | | 100 | | r | |
| Tanigan extra A, aqueous | any | 20 | – | Wax alcohol | 100 | 60 | cr |
| Tanigan extra B, aqueous | any | 20 | – | Wine, red and white | com. avail. | 20 | r |
| Tanigan extra D, aqueous | saturated | 40 | – | Xylene | 100 | 20 | nr |
| | saturated | 60 | – | Yeast wort | custom. conc. | 40 | r |
| Tanigan F, aqueous | saturated | 60 | – | custom. conc. | 60 | r | |
| Tanigan U, aqueous | saturated | 40 | – | Zinc chloride, aqueous | diluted | 40 | r |
| | saturated | 60 | – | diluted | 60 | r | |
| Tanning extracts, cellul. | common | 20 | r | saturated | 60 | r | |
| Tanning extracts, natural | common | 20 | r | Zinc sulphate, aqueous | diluted | 40 | r |
| | | | | diluted | 60 | r | |
| | | | | saturated | 60 | r | |

AS 1530.4

Method for fire tests on building materials, components and structures
Part 4: Fire-resistance test of elements of construction

AS 2887

Plastic waste fittings

AS/NZS 3500.2

Plumbing and drainage
Part 2: Sanitary plumbing and drainage

AS/NZS 7671

Plastic piping systems for soil and waste drainage (low and high temperature) inside buildings - Polypropylene (PP)

DIN 1054

Ground – Verification of the safety of earthworks and foundations

DIN 1055 Part 2

Design loads for buildings; soil characteristics; specific weight, angle of friction, cohesion, angle of wall friction

DIN 1986

Drainage systems on private ground

DIN 4060

Pipe joint assemblies with elastomer seals for use in drains and sewers, requirements and tests

DIN 4102

Fire behaviour of building materials and elements

DIN 4124

Excavations and trenches – Slopes, planking and strutting, breadths of working spaces

DIN EN 476

General requirements for components used in discharge pipes, drains and sewers for gravity systems

DIN EN 681

Elastomeric seals
Material requirements for pipe joint seals used in water and drainage applications

DIN EN 752

Drain and sewer systems outside buildings

DIN EN 1610

Construction and testing of drains and sewers

DIN EN 12056

Gravity drainage systems inside buildings

General building construction approval from the German Institute of Building Technology (DIBt)

Approval Z-42.1-223
RAUPIANO PLUS waste pipes and fittings
Approval Z-19.17-1662
REHAU PLUS fireproofing collar system
Approval Z-19.17-1363
REHAU "kompakt" fireproofing collar system
Approval Z-19.17-1268
REHAU angled fireproofing collar system

NOTES

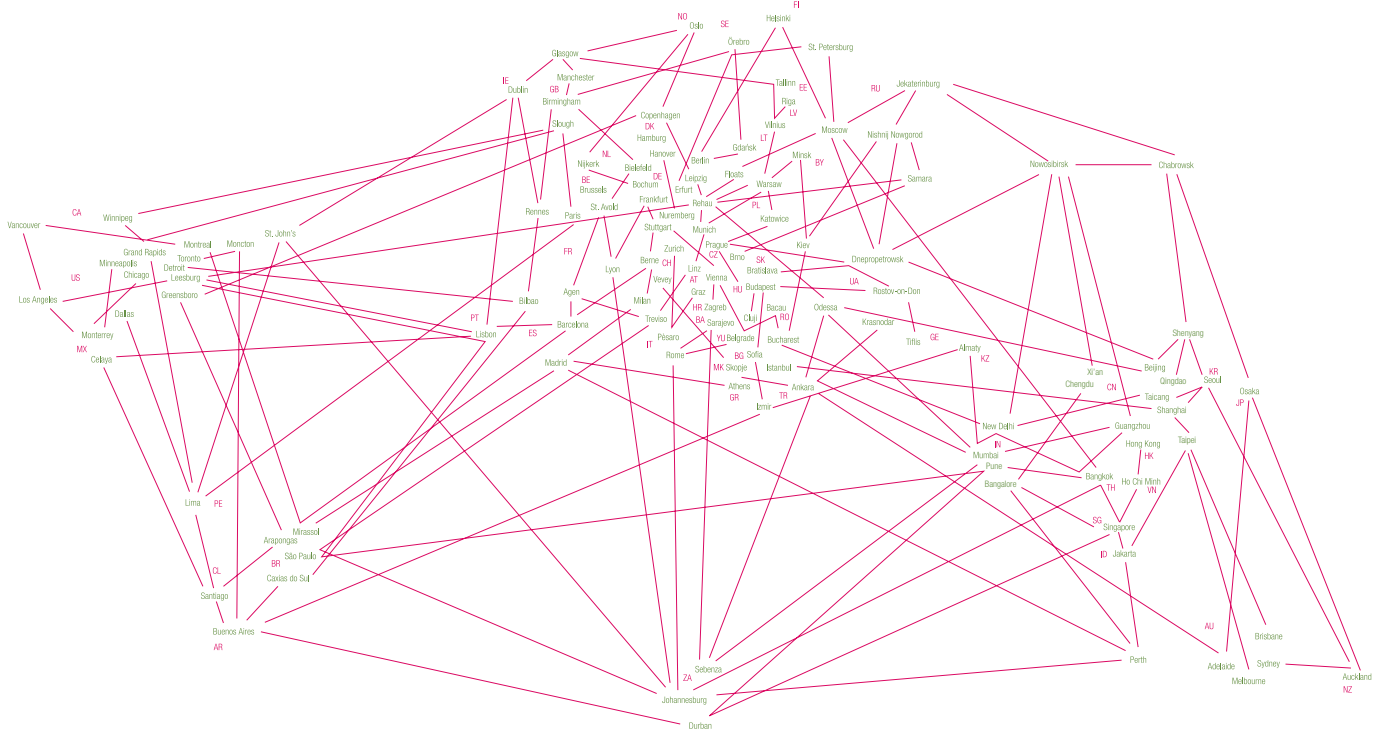
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NOTES

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