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RAUPIANO PLUS Acoustic Drainage

Technical Information

REHAU

www.myrehau.com
Valid from 2025
Subject to technical modifications

Contents

This Technical Information **RAUPIANO - Acoustic Drainage** - is valid from **2025**.
This publication means that the previous Technical Information is no longer valid.

The latest version of this Technical Information can be found at **www.myrehau.com/buildingsolutions/library** or **www.myrehau.co.nz/library** for download.

All measurements and weights are of approximate values.
Errors and changes are to be expected.

01 Information and safety recommendations

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 RAUPIANO PLUS, please ensure you are using the latest version of the technical information. The date of issue of your technical information is always printed at the bottom right of the cover page.
The current technical information is available from your REHAU sales office, or as download on the Internet at www.reece.com.au or **www.rehau.com.au** or **www.rehau.co.nz** , **www.myrehau.com/buildingsolutions/library** and **www.myrehau.co.nz/library**

- 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.
- If you do not understand the safety recommendations or installation instructions, or if they are unclear, contact your REHAU sales office. Refer to back page for contact details.

Intended use
The system RAUPIANO PLUS may only be installed and operated as described in this technical information. Any other use is unintended and therefore not permitted.

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.

Personnel requirements
- Allow only authorised and trained persons to assemble RAUPIANO systems.
- Work on pipe and components should 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 as they could be caught by moving parts.
- Wear a protective helmet when performing assembly work at head level or above your head.
- Wear NBR gloves when applying lubricant by hand.

When assembling the system
- Always read and comply with the respective operating instructions of the tool being 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 alteration work and when changing the place of assembly, always unplug the power cable of the tool and take measures to ensure it cannot be switched on inadvertently.

02 System introduction

Advantages

- Excellent sound insulation properties, no acoustic lagging required as outlined in section 4
- Mineral-filled material for pipes and fitting to reduce air-borne noise
- Partially thickened walls for bend fittings to improve air-borne sound insulation
- Special sound-dampening bracket to reduce transmission of structure-borne noise
- **Fast and easy installation**
- **Built-in push-fit socket with factory-fitted sealing ring providing flexible and vibration-resistant joints. Results in 100% leak-proof connection**
- **High quality product**
- Excellent impact resistance - robust for transport, storage and handling at construction site
- UV-resistance, can be stored outdoor for 1 year
- Smooth yet abrasion-resistant inner layer to reduce risk of deposits and scaling
- Temperature resistance up to 98°C for brief periods
- Chemical resistance from pH 2 – 12, making it suitable for trade waste applications. Refer to Chapter 13
- Fracture resistant at –10 ˚C
- High ring stiffness (SN 4)
- Complete pipe, fitting, adapters and bracket range
- **Green material, non-toxic material without halogens, and 100% recyclable**

2.1 Application

The sound-insulating drainage system RAUPIANO PLUS is suitable for above ground installations (inside buildings only) and below ground installations. This is in accordance with AS/NZS 3500.2 and the National Construction Code (NCC) Volume 3 as certified under Watermark WM70060 in buildings and WM71503 below ground. Installation must be carried out in accordance with AS/NZS 3500.2 and the NCC. Observations of DIN EN 12056, DIN EN 752, DIN 1986-100 and DIN EN 1610 are also recommended.

Behaviour in fire corresponds to B2 normal combustibility according to DIN 4102 and D-S2,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). The Push-Fit Lock socket connection allows for a higher pressure of up to 2 bar (20 m water column). See section 7.12 for more information.

WaterMark

BRANZ Appraised
Appraisal No.809

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:

- Double storey homes
- Multi-storey apartment blocks
- Condominiums
- Multi storey townhouses

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
- Shopping Centres
- Supermarkets
- Aged Care Facilities
- Schools

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

2.1.3 Greasy trade waste

RAUPIANO Plus system (pipes, fittings and sleeves) can withstand extreme temperatures. Refer to Table 2-1 for detailed information on RAUPIANO's temperature resistance.

Domestic applications:

Temperature and Time Limit	Lifespan
Continuous operation at 60°C	Total 50 years
+ 2 hours/day at 80°C	
+ 1 hour/day at 90°C	

Commercial applications:

Temperature and Time Limit	Lifespan
Continuous operation at 40°C	Total 50 years
+ 3.5 hours/day at 80°C	
+ 1 hour/day at 90°C	
+ 10 mins/day at 95°C	
+ 1 min/day at 98°C	

Table 2-1 Domestic and commercial applications

They are suitable for the drainage of chemically aggressive waste water with a pH value of 2 (acidic) to 12 (basic). Please refer to the chemical resistance list in Chapter 13.

RAUPIANO PLUS is ideal for drainage of greasy waste water from commercial kitchens up to the grease separator.

For lengthy grease waste lines, 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 65°C.

PVC adaptors are not approved for use in applications that exceed 60°C, including trade waste applications. See page 35 for more information.

2.1.4 Unsuitable applications

Pipes and fittings may not be used for:

- installation subjected to conditions outside of the RAUPIANO temperature profile table in Section 2.1.3
- carrying waste water containing prohibited chemicals (see chapter 13)
- exposed installation to UV radiation (e.g. sunlight) directly and indirectly
- fuel stations
- oil discharge

RAUPIANO PLUS is not suitable for siphonic drainage systems. 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.

2.2 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 middle layer ensures superb sound dampening properties and also offers increased stiffness. Finally, the robust outer layer is tough enough to withstand impacts and shocks.

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

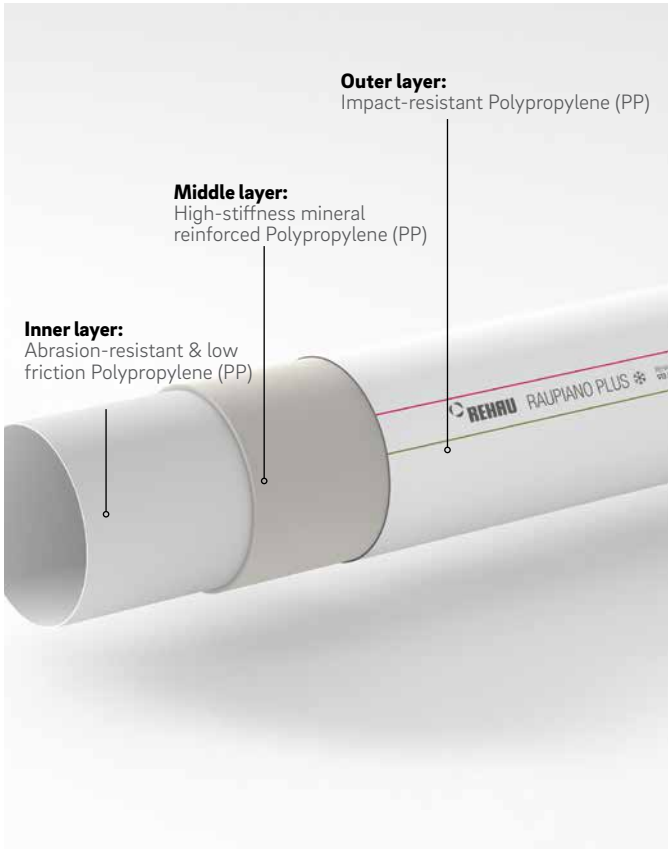


Fig. 2-1 RAUPIANO PLUS pipe structure.

2.3 Fittings

Redirection of water flow at bends causes increased turbulence which results in greater air-borne sound transmission.

RAUPIANO PLUS bends from size DN110 to DN160 consist of targeted mass optimisation zones which help to reduce sound transmission in these areas.

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

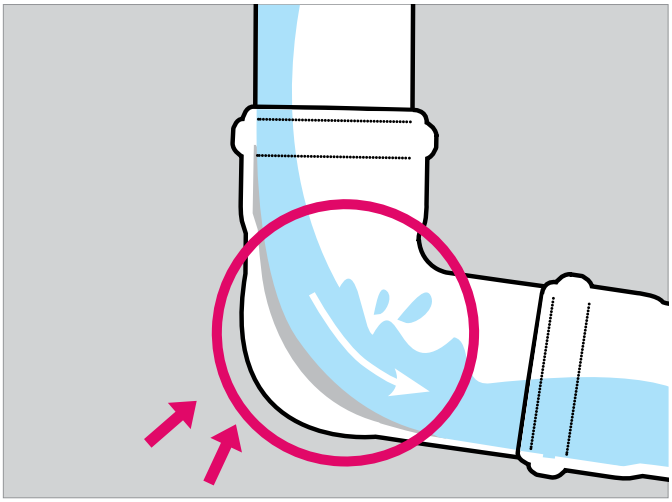


Fig. 2-3 Specially designed bends with increased wall thickness reduce airborne sound even further.

03 Transport, storage and handling

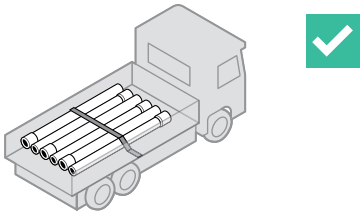
Transportation
RAUPIANO's robust design is proven during transport and at the construction site thanks to its three-layer structure and impact-resistant and shock-proof outer layer. Ensure that the entire length of pipes makes firm contact with the storage and transport surfaces.

Storage
- Protect boxes from moisture during transport and storage.
- RAUPIANO PLUS pipes and fittings, and its seals can be stored outdoors for up to 1 year

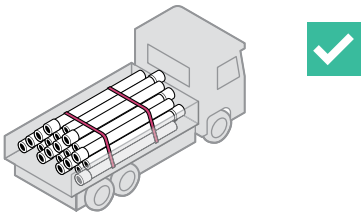
We recommend:
- Protecting RAUPIANO PLUS pipes and fittings from direct sunlight and soiling by:
  - storing in the box
  - covering them with tarpaulins (ensure proper ventilation).
- Stack no more than two wooden crates on top of one another.
- Ensure that the wood frames are aligned squarely when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

RAUPIANO delivery procedure
Key points to remember:
- Treat RAUPIANO with care to avoid damage.
- Do not over tighten the ratchets or fasteners used to secure the pipes for transportation.
- Pipe can still be used with small scratches / surface damage as long as both the male and female ends are not damaged and the O-ring is in place.

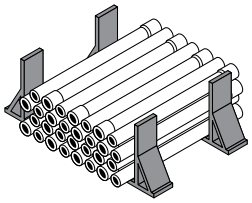
Correct transportation procedure	What not to do



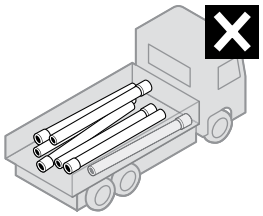
Where possible use a truck for deliveries. Lay pipe flat on the tray



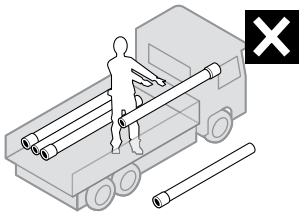
Keep pipes strapped down so they don't roll around and remain supported.



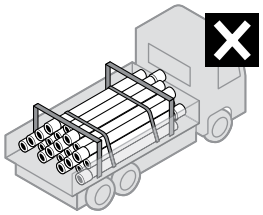
Alternate socket and pipe ends when loading pipe



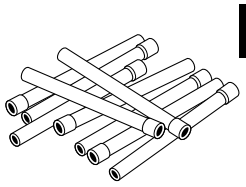
Do not throw pipe into the tray



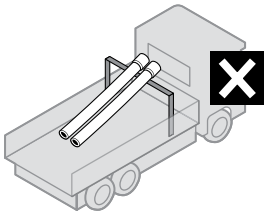
Do not throw pipe off the transport vehicle



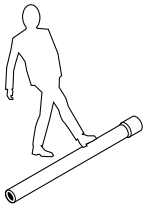
Do not over tighten with ratchets or fasteners



Take care with O-rings and ensure they are in good condition



Do not leave long free lengths of pipe unsupported as pipe may bend or deform slightly over time



Keep pipes clear of building debris whilst on site and do not subject the pipes to undue load i.e. machinery or people

Fig. 2-4 Transporting of RAUPIANO PLUS

04 Sound insulation

4.1 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 sanitary plumbing and the accompanying sanitary drainage.

Typical sources of sound include:
- Turbulence at changes of flow direction (fittings)
- Fixture filling noise
- Drainage noise
- Inlet noise
- Impact noise

Unsuitable drainage systems and accompanying brackets are considerable contributors to disturbing noise. RAUPIANO PLUS, a system-tested, versatile sound-insulating drainage system addresses these concerns.

Air-borne noise
Air-borne noise is the sound generated from a source that is transferred through air.

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.

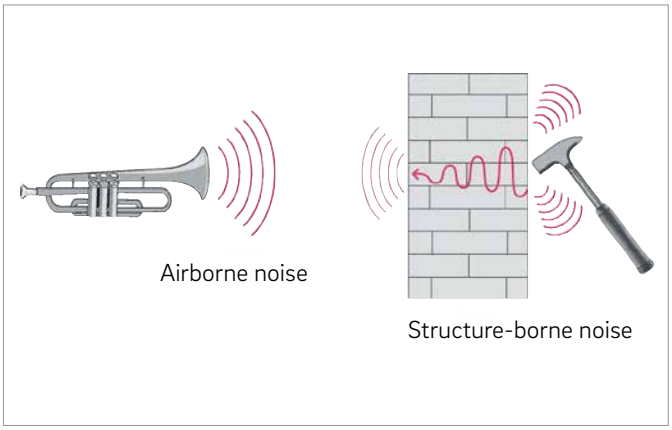


Fig. 4-1 Air-borne and structure-borne noise.

4.2 Sound insulation requirements for Australia

Sound insulation requirements differ from country to country and from one building type to another. In Australia the NCC / BCA Volume One Part F7 outlines the requirements for sound insulation:

- F7D7 Sound insulation rating of internal 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:

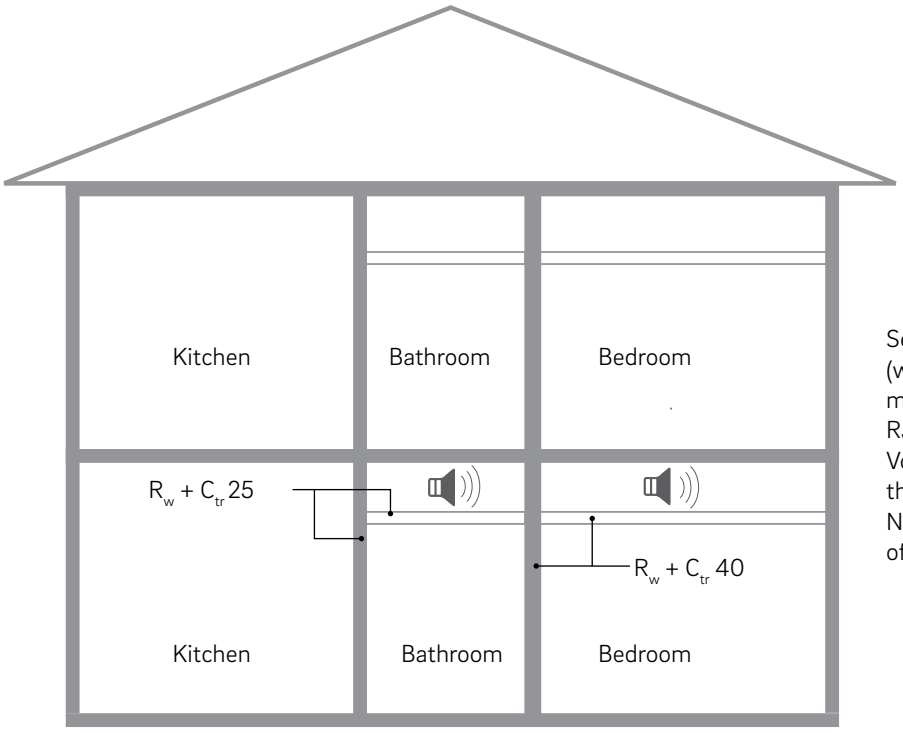
- 40 if the adjacent room is habitable (other than a kitchen); or
- 25 if the adjacent room is a kitchen or non-habitable

For the Northern Territory:

- R_w 45 if the adjacent room is habitable (other than a kitchen); or
- R_w 30 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.



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 F7D7 for services passing through habitable rooms. For the Northern Territory a sound reduction level of R_w 45 is required.

Fig. 4-2 NCC/BCA Acoustic requirements.

4.3 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 water 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, its inner sound dampening material and installation method.

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 due to special materials, sound-dampening minerals and increased weight of the pipe system. Targeted mass optimisation in sound-sensitive areas of fitting elbows of nominal diameter DN 110 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 sound dampening brackets:

- A supporting bracket with free space between the pipe and bracket rubber lining is fastened to the wall
- A fastening bracket rests on the supporting bracket, 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 section 7.3.5 for installation details).

UNPROTECTED PIPEWORK

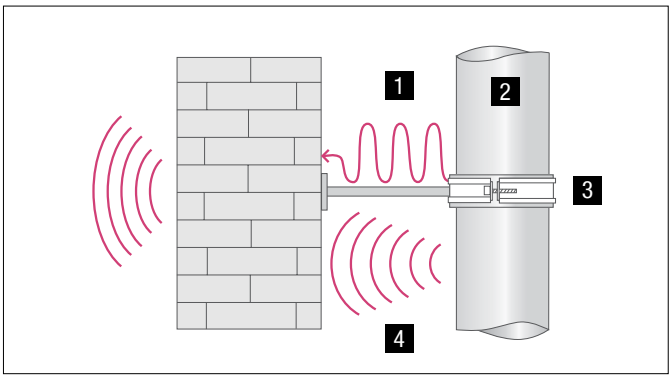


Fig. 4-4 Sound distribution with drainage pipe systems.

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

PROTECTED PIPEWORK

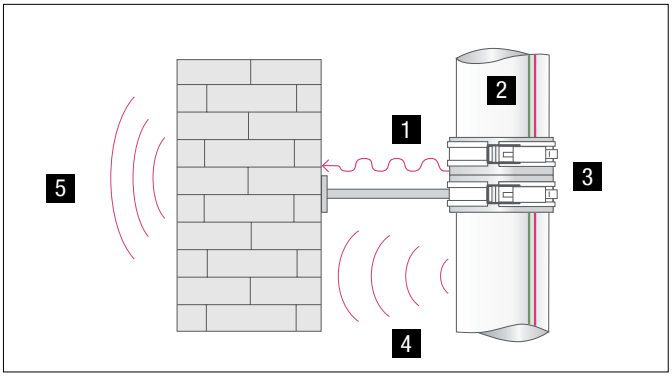


Fig. 4-5 Sound insulation with RAUPIANO PLUS.

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

4.4 Laboratory testing of sound-insulation behaviour

4.4.1 Acoustic testing

Acknowledging the different installation practices and the effects on acoustic level reading in the building, REHAU engaged several acoustic consultants to perform extensive acoustic tests on RAUPIANO PLUS drainage system in different configurations. The acoustic tests were performed in:

- National Acoustic Laboratory (NAL) by Renzo Tonin & Associates
- McLay Industries Facility (MIF) by ASK Consulting Engineers
- Technical and Further Education South Australia (TAFE SA) by AECOM

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

To ensure close proximity to real-life noise, full-toilet flush was used during measurement. Full-toilet flush represents the worst-case scenario in a domestic drainage environment. The water swirling and turbulence from a toilet flush and therefore the noise created by them, cannot be replicated by any other noise source such as continuous water flow.

4.4.2 Acoustic test results

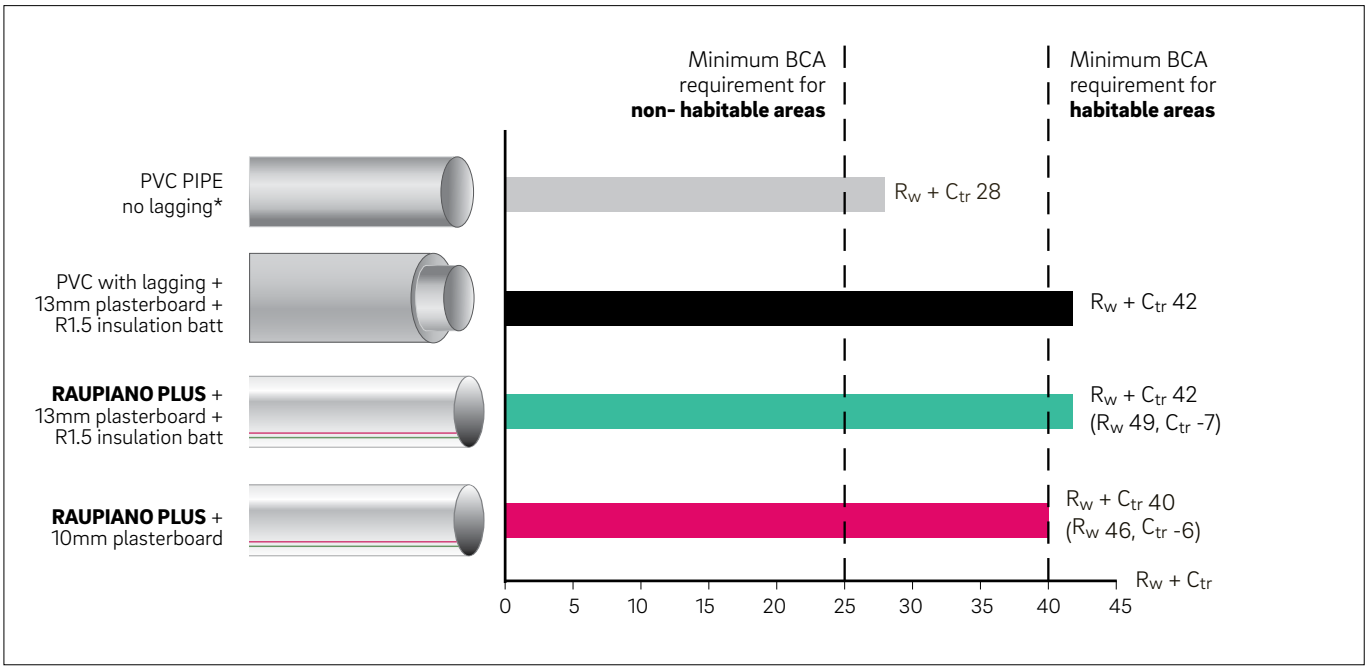
In Australia buildings can be classified into two categories:
- For buildings regulated by NCC/BCA
- For buildings not regulated by NCC/BCA

Our extensive acoustic test results provide the necessary data for both categories.

Buildings complying with NCC/BCA

From very extensive raw data collected through real-life acoustic tests, AECOM assessed the acoustic performance of RAUPIANO PLUS and it was positively concluded that RAUPIANO PLUS achieves Rw + Ctr 40 (Rw 46) with 10 mm plasterboard alone. That means RAUPIANO PLUS satisfies the BCA's acoustic requirements for habitable and non-habitable areas with just 10 mm plasterboard, without pentrations, lagging and insulation batt.

The acoustic assessment letters from the acoustic consultants (Renzo Tonin & Associates, ASK Consulting Engineers, and AECOM) can be provided upon request.



Acoustic testing
* Boral Selector + Feb 2009 - System WP13, 13mm std core plasterboard with insulation (Graeme E Harding & Associates)

RAUPIANO PLUS perfromance is confirmed once a ceiling is in place. Exposed RAUPIANO PLUS installation can compromise the acoustic performance.

To ensure full compliance to the NCC/BCA acoustic requirements, the following configurations are recommended:

RAUPIANO PLUS recommended acoustic configurations

$R_w + C_{tr}$ 25 (non-habitable areas)
$R_w + C_{tr}$ 40 (habitable areas)

$R_w + C_{tr}$ 42 (habitable areas)

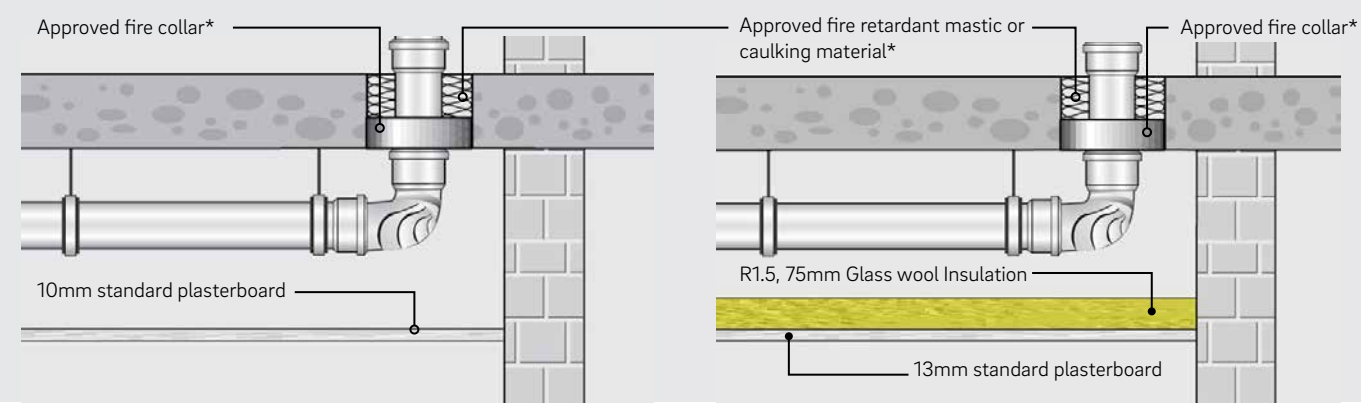


Fig 4-7 Recommended suspended ceiling configurations to comply with NCC/BCA acoustic requirements

* The above schematic shows a general example and is not intended to satisfy the installation requirements for any particular project. Specific fire protection measures may or may not be required depending on building class and design, check with fire engineer and refer to the National Construction Code for detailed information.

Buildings conforming to other acoustic requirements
The acoustic requirements of buildings outside of NCC/BCA's scope tend to be different. The rooms are normally classified differently, and therefore have different noise level requirements.

RAUPIANO PLUS has gone through extensive acoustic testing with different ceilings, ranging from flush plasterboard to Rondo ceiling grid system with lay in tiles, and with different plasterboard thicknesses.

- RAUPIANO PLUS produces lower noise levels compared to lagged PVC and lagged HDPE when the suspended ceiling is installed with insulation batt.

- RAUPIANO PLUS produces lower noise levels compared to lagged PVC when it is installed in wall cavity (vertical stack pipe), when the wall cavity is installed with insulation batts.

- RAUPIANO PLUS produces noise levels within 3 dB(A) compared to lagged PVC and lagged HDPE when the suspended ceiling is installed without insulation batts. This noise difference is not noticeable to the human ear.

RAUPIANO system shall be decoupled from all other structures, materials and services to minimize sound transmission.

05 Fire protection

5.1 Fire-protection requirements

Fire-protection measurements may be necessary if pipes penetrate through fire-rated building elements in a building.

§ The national regulations, codes and standards shall be observed for fire protection.

5.2 Fire collars

RAUPIANO PLUS system can be installed with suitable fire collars which have been tested and proven according to AS 1530.4 to fulfill the fire protection requirements from NCC/BCA.

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

Avoid direct contact between RAUPIANO PLUS pipe and the building element to avoid transmission of structure-born noise into the building element. Use fire rated soft caulking material to close gaps between the fire collar and the pipe. The caulking material must be tested and approved by the manufacturer of the fire collar to be installed together with RAUPIANO PLUS pipe.

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

Some Fire Collar Manufacturers have approved solutions for RAUPIANO Pipe in the fire collar and some have approved solutions for the pipe and socket in the fire collar. Refer to fire collar manufacturers for this detail.

ⓘ Wall penetrations require two collars (on both sides of the wall). All floor waste gullies require specific fire protection solutions.

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

Approved fire collar solutions for RAUPIANO PLUS pipe are available from the following manufacturers:

- **Promat (1800 776 628 or www.promat.com.au)**
- **Snap (1300 76 46 26 or www.snapcollars.com.au)**
- **Hilti (131 292 or www.hilti.com.au)**
- **Allproof (+64 9 481 8020 or http://allproof.co.nz)**
- **Boss Fire (1300502677 or www.bossfire.com.au)**

IMPORTANT: Not every fire collar is tested and approved with RAUPIANO PLUS

Contact the manufacturer of the fire collar for information on fire test results and assembly/installation instructions to determine which solution suits your requirements.

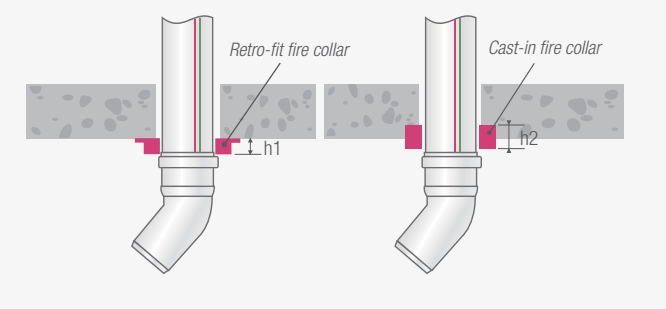


Fig. 5-2 Installation of fireproof collar in ceiling*

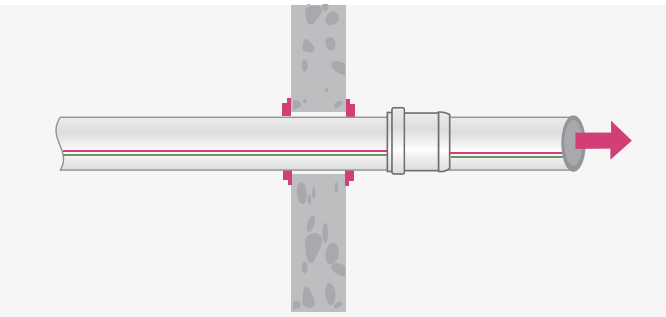


Fig. 5-3 Installation of fireproof collar on wall*

* General example only. Refer to fire collar manufacturer for installation details.

06 System design

6.1 General Requirements

The design, planning, installation and commissioning of RAUPIANO PLUS drainage system shall comply to AS/NZS 3500.2 and this Technical Information.

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

- Back siphoning and loss of water seals must be prevented
- Sufficient ventilation of the drainage system must be ensured
- Nominal diameter larger than those calculated are not to be used to ensure effective drainage
- Drainage system must comply with the requirements of the NCC/BCA where necessary
- Anaerobic digestion is to be prevented
- Gas emissions are to be lead out without harmful effects via the main ventilation system

6.2 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
100	110	110	110
150	160	160	160

Table 6-1 Equivalent pipe sizes.

When connecting RAUPIANO PLUS directly to PVC systems, some dimensions require connection adapters. Refer to chapter 9 for details.

6.3 Specification

General

RAUPIANO PLUS system is suitable for drainage, stormwater and trade waste applications (see section 2.1.3 for further details). It can be installed inside the building and below ground in line with the relevant standards.

Standards

NCC/BCA	National Construction Code / Building Code of Australia
NZBC	New Zealand Building Code
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)
AS/NZS 5065	Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

Approval in Australia and New Zealand

Pipes and fittings are certified under Watermark Certificates WM70060, WM71501 and WM 71502 for sizes DN 40 to DN 200 and also under WM 71503 for sizes DN110 to DN200. RAUPIANO PLUS bears the BRANZ appraisal in New Zealand.

System components – Pipes and Fittings

All pipe and fitting materials comply with AS/NZS 7671 for gravity drainage in residential and commercial applications.

Pipes and fittings are designed for a range of operating temperatures including high temperature waste water drainage (see section 2.1.3 for full details). They have a high degree of chemical resistance and withstand acidity level from pH 2 - 12.

System components - Sound-dampening bracket

The sound-dampening bracket is rubber-lined and acts as a vibration decoupler to reduce the structure-borne noise transmitted from the RAUPIANO PLUS system.

System components - Floor Waste Gully

The Floor Waste Gully material is polypropylene RAU-PP. The Floor Waste Gully has 1 floor waste main inlet in dimension DN (OD) 110mm with socket and 3 additional inlets in dimension DN (OD) 50mm. The outlet is DN (OD) 75mm. The floor waste gully has no baffle and no parts are needed to be removed in order to perform maintenance or cleaning if necessary. The minimum water way is 80% larger than the minimum standard requirements and allows for greater flow and less accumulation of debris.

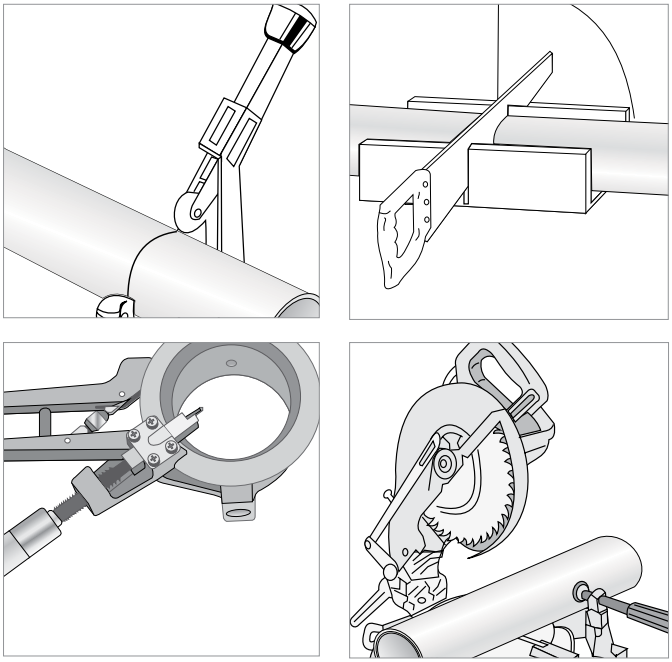
Connections

The connections between the polypropylene pipes and fittings are leak-proof push-fit socket connections. The connections are able to withstand internal pressure of up to 100 kPa (higher with pushfit lock as described in section 7.12) and accommodate thermal expansion.

07 Installation

All schematics show general examples only and are not intended to satisfy the installation requirements for any particular project. For the installation of RAUPIANO PLUS waste water piping system, national and local codes, rules and regulations, as well as local / project-specific conditions and the demands of the end use customer need to be considered.

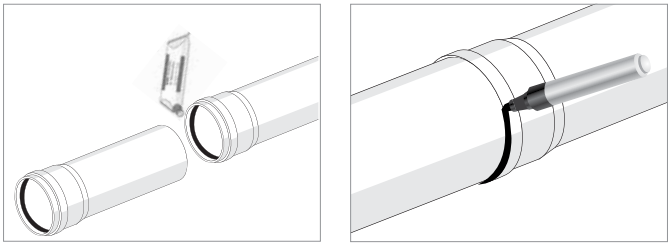
7.1 Cutting and Chamfering



1. **Cut the pipes with common pipe cutters or a fine-toothed saw.**
2. **Make a cut at 90° angle from the pipe axis (cut square).**
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 (i.e. Rothenberger Rocut tool <Reece code 7705255> for pipes DN40 to DN110 or a coarse file at an angle of approximately 15°).**

Fittings shall not be cut.

7.2 Pipe Assembly



1. Clean dirt from sealing ring, socket interior and pipe end.
2. Use small amount of RAUPIANO lubricant (eg. a 10mm drop) to moisten male end and O-ring and slide into the socket until it stops.
3. Mark inserted male end in this position at the socket edge with a pencil, pen etc.

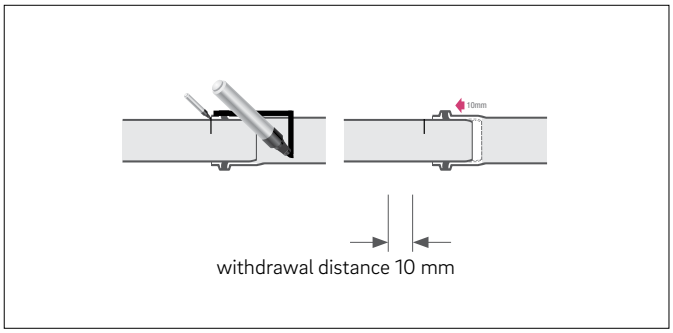


Fig. 7-1 Pulling out pipe ends for expansion joints.

To accommodate thermal expansion of RAUPIANO system, the following conditions are recommended. Ensure witness mark is visible to ensure that the pipe is not accidentally pulled out.

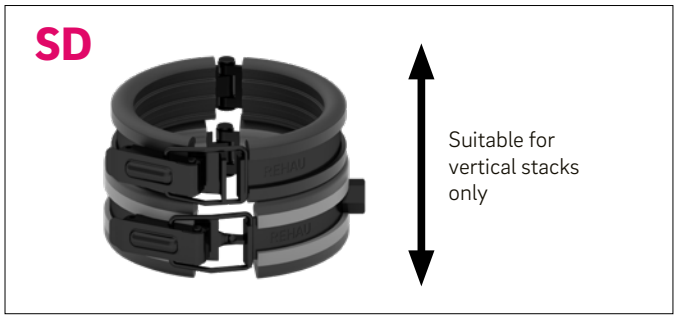
Insert fully and pull out 10mm per pipe for:
- Pipes longer than 500mm;

Insert spigot end fully into socket for:
- Pipes shorter than 500mm;
- In ground applications;
- Fitting to fitting.

Below ground installation
When the pipe is installed below ground it is **not** required to pull the male end out by 10mm to provide an expansion joint.
Each RAUPIANO PLUS pipe socket 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).

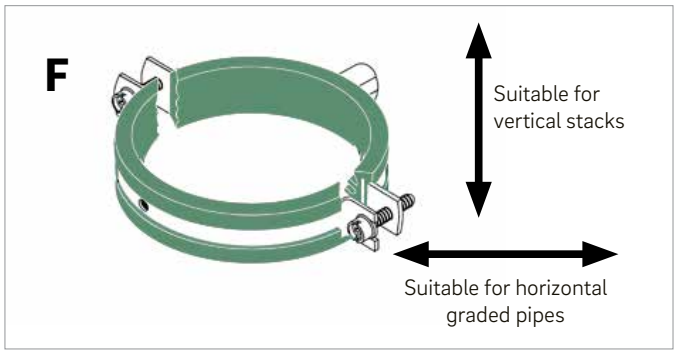
7.3 Bracketing

7.3.1 Bracketing in Australia



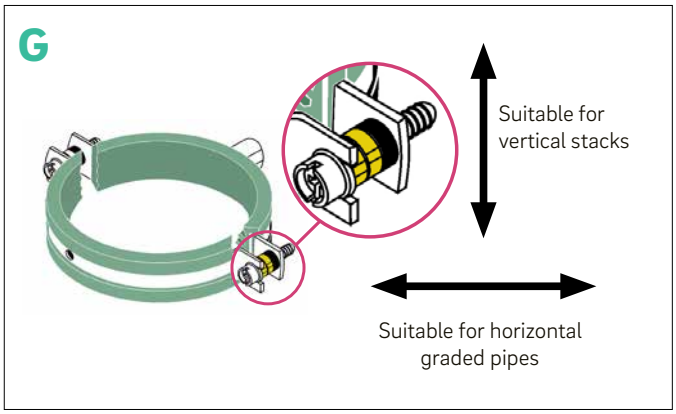
Sound-dampening bracket

- Minimizes transmission of vibrations from pipe through fixing into wall via acoustic de-coupling.
- Consists of loose and tight bracket:
  - lower bracket (loose) attaches to wall
  - upper bracket (tight) supports pipe.
  - attach to vertical stack only
  - 1 required per floor, per stack
  - REHAU proprietary



Fixing/security bracket

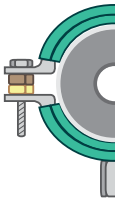
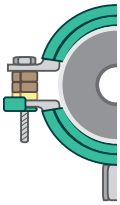
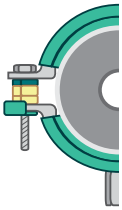
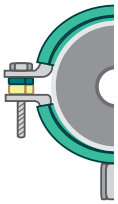
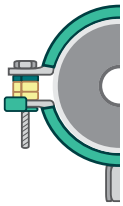
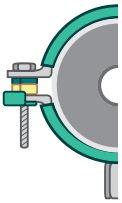
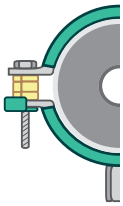
- Model: Walraven Bifix 5000 G2 (light green)
- This is the same model as Guiding bracket (above), however when used as a fixing/ security bracket, it is to be installed with some spacers removed. See table in next page for full details.
- Always tight on pipe
- When used as fixing bracket on graded pipes: **fix to ceiling**
- When used as security bracket in vertical stacks: install directly below and in contact with the bottom edge of the loose Sound dampening bracket on every third floor. **Never fix to wall.**



Guiding bracket

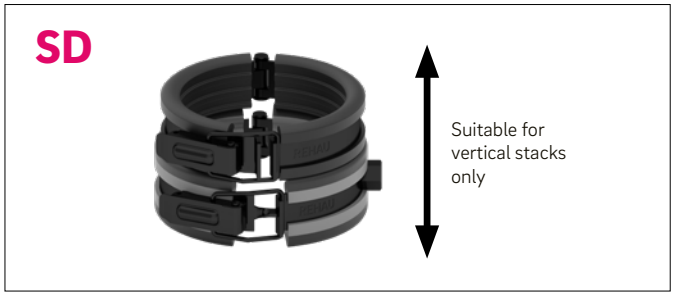
- Model: Walraven Bifix 5000 G2 (light green)
- This is the same model as fixing/security bracket (below), however when used as a guiding bracket, it is to be installed as received, with all spacers. See table in next page for full details.
- Allows for thermal expansion of the pipe
- Always loose on pipe.
- Fix to ceiling on graded pipes
- Fix to wall on vertical stack

7.3.2 Spacer Installation

Pipe Size (DN)	Guiding Bracket	Fixing Bracket
40 	Install as supplied – 2 spacers on each side (1 x brown and 1 x yellow)	 **Remove:** 1 x yellow spacer from each side. **Install with only:** 1 x brown spacer on each side
50 	Install as supplied – 3 spacers on each side (2 x brown and 1 x yellow)	 **Remove:** 1 x yellow spacer from each side. **Install with only:** 2 x brown spacers on each side
75 	Install as supplied – 3 spacers on each side (2 x yellow and 1 x green)	 **Remove:** 1 x yellow spacer from each side. **Install with only:** 1 x yellow spacer and 1 x green spacer on each side
110 	Install as supplied – 3 spacers on each side (2 x yellow and 1 x green)	 **Remove:** 1 x yellow spacer from each side. **Install with only:** 1 x yellow spacer and 1 x green spacer on each side
160 	Install as supplied – 3 yellow spacers on each side	 **Remove:** 2 x yellow spacer from each side. **Install with only:** 1 x yellow spacer on each side

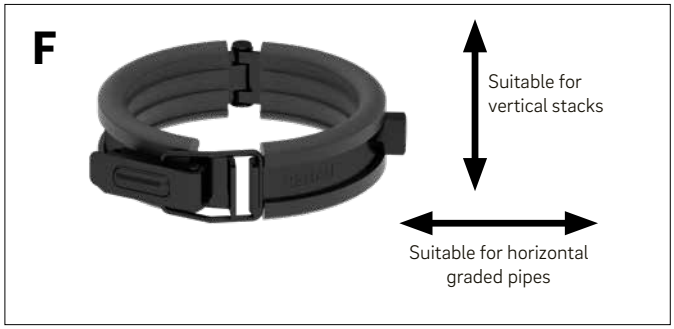
Note: Spacer installation has been depicted for one side of pipe only. This needs to be replicated on both sides of the pipe.

7.3.3 Bracketing in New Zealand



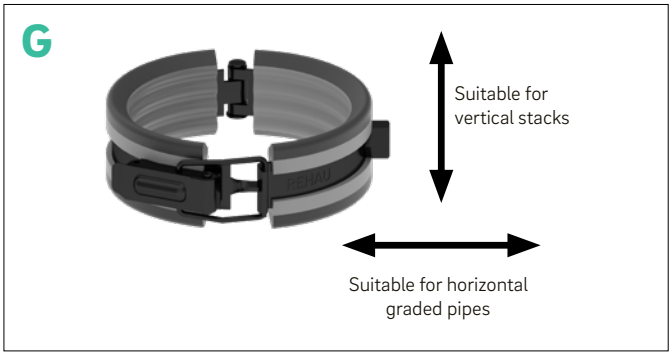
Sound-dampening bracket

- Minimizes transmission of vibrations from pipe through fixing into wall via acoustic de-coupling.
- Consists of loose and tight bracket:
  - lower bracket (loose) attaches to wall
  - upper bracket (tight) supports pipe.
  - attach to vertical stack only
  - 1 required per floor, per stack
  - REHAU proprietary



Fixing/security bracket

- Model: REHAU Fixing/Security Bracket
- Always tight on pipe
- When used as fixing bracket on graded pipes: **fix to ceiling**
- When used as security bracket in vertical stacks: install directly below and in contact with the bottom edge of the loose Sound dampening bracket. **Never fix to wall.**



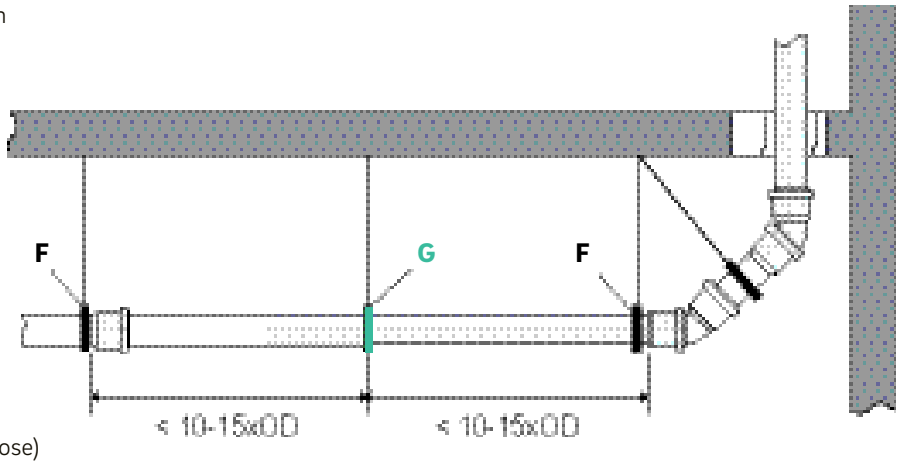
Guiding bracket

- Model: REHAU Guiding Bracket
- Allows for thermal expansion of the pipe
- Always loose on pipe.
- Fix to ceiling on graded pipes
- Fix to wall on vertical stack

7.3.4 Bracketing plan for horizontal pipes

The general concept of bracketing RAUPIANO Plus in graded drainage is to fix the pipe in a location immediately behind the pipe sockets. The remaining brackets until the next socket should observe the required bracket spacing (RAUPIANO requirements or standard requirements as necessary) using guiding brackets, to allow for thermal expan
socket.

The installer must always assess the situation on site and install additional bracketing where additional support is required while maintaining this general approach.



G - Guiding bracket (loose)

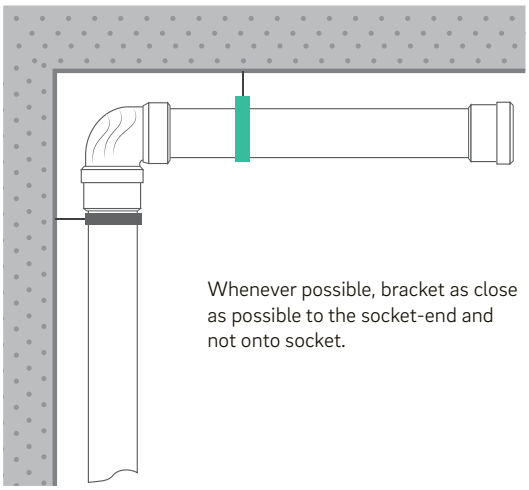
F - Fixing bracket (tight)

Pipe size (DN)	Collar OD (mm)	Pipe thickness (mm)	Pipe ID (mm)	Maximum recommended bracket spacing (mm)*	Maximum bracket spacing according to AS/NZS 3500
40	52.8	1.8	36.4	15 x OD (600mm)	1000mm
50	62.8	1.8	46.4	15 x OD (750mm)	1000mm
75	87.9	1.9	71.2	10 x OD (750mm)	1000mm
110	125.6	2.7	104.6	10 x OD (1100mm)	1000mm
160	180.7	3.9	152.2	10 x OD (1600mm)	1000mm

Table 7-1 Maximum recommeded bracket spacing for RAUPIANO pipes

* Spacing requirements where compliance to AS/NZS 3500 is not required.

- Don't use sound-dampening bracket on horizontal lines.
- Install fixing bracket at socket end followed by guiding brackets at the required spacing until next joint.
- Install fixing bracket downstream, as near as possible to the socket end.
- If more than 3 fittings are joined together in the same line, ensure the group of fittings are sufficiently supported to avoid sagging, twisting and to prevent the connections from sliding apart.
- Recommended bracket spacing for all pipe sizes are shown in Table 7-1.
- REHAU sound dampening brackets and Walraven brackets were used for all acoustic tests. The use of other brackets with different properties may compromise the acoustic performance of RAUPIANO PLUS.
- When there is a 90° change in pipe direction, bracketing must be carried out as shown in the diagram. The guiding bracket must be installed as close to the socket as possible, and no more than 200 mm away from the socket. This ensures adequate joint security.



Whenever possible, bracket as close as possible to the socket-end and not onto socket.

It is recommended to have fixed brackets as close to the back side of the pipe socket as possible to support the joint as shown in figure 7-9 below.

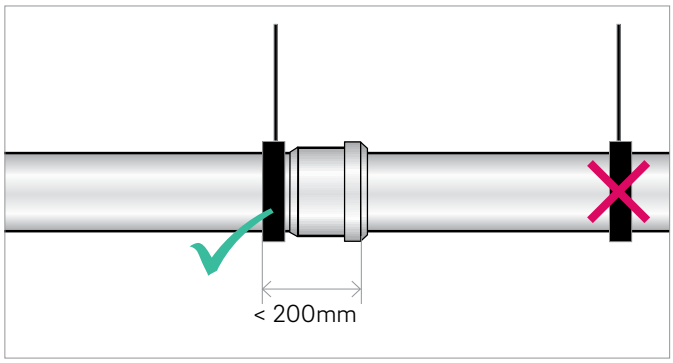


Fig. 7-9 Correct fixed bracket location behind pipe sockets

If fittings or obstructions prevent bracketing at 15 x OD, reduce bracket spacing.

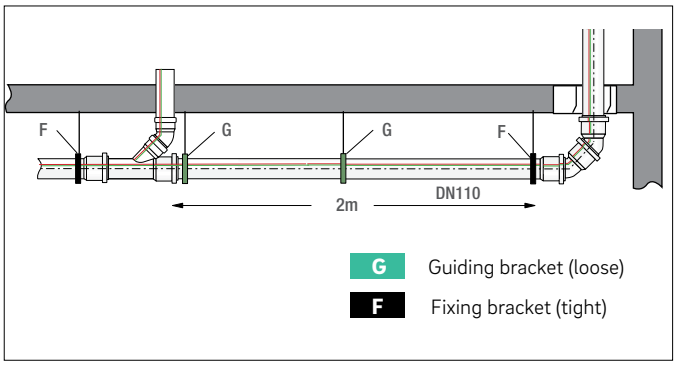


Fig. 7-11 Bracketing plan for graded pipes

Sound-dampening support brackets are not required for graded pipe installations.

Pipe support - Anchor points

Anchor brackets are used when the distance between the ceiling and top of pipe is greater than 300mm.

Anchor brackets (ie. anchor points or tri-brackets) are required in the following applications:

1 For straight lines:
- Temperature ≤60°C - L1 ≤6m
- Temperature ≥60°C - L1 ≤ 4m

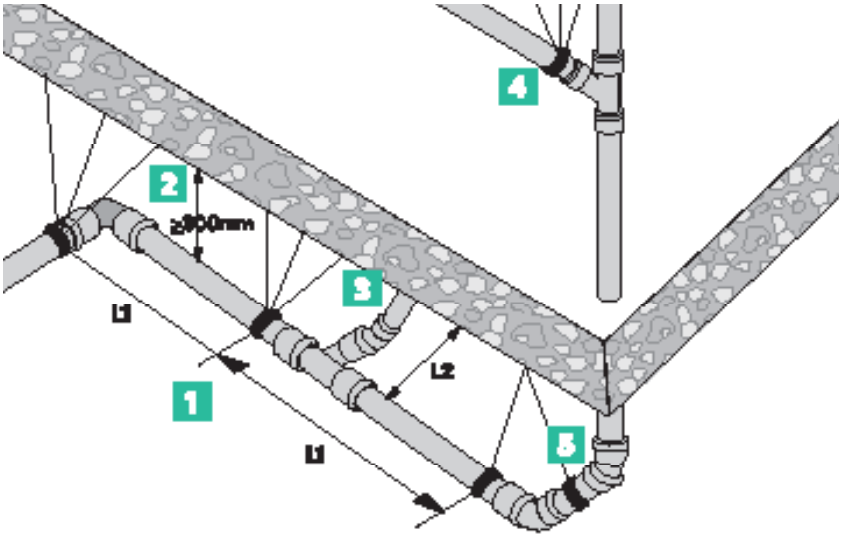
2 Install anchor brackets at changes in flow direction

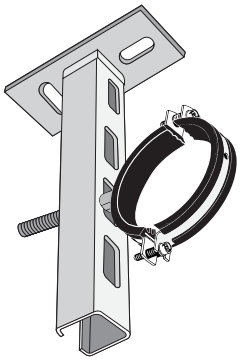
3 For junctions:
- Temperature ≤60°C and branch length (L2) ≥2m - Install anchor bracket on main line
- Temperature ≥60°C and branch length L2) ≥1m - Install anchor bracket on main line

4 Install anchor brackets at entry to stacks

5 Install anchor brackets after stack rolls

This is a recommended solution and not seismic tested.





Fixed bracket with Unistrut

Tri-brackets

Please consult with REHAU if you have any questions.

7.3.5 Pipe support - Sound dampening brackets

7.3.5.1 Vertical stack

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

RAUPIANO PLUS drainage pipes must be installed tension-free.

7.3.5.2 Assembly of Sound Dampening Brackets

The sound-dampening support bracket consists of a support bracket with a spacer (closes loosely around the pipe and is anchored firmly to the wall) and a fastening bracket (closes tightly around the pipe without any contact to the wall). The quick-snap buckle always ensures the perfect closing force.

Only one sound dampening bracket per stack per floor is required and it is not necessary to mount the support bracket directly underneath a socket.

1. Fit fastening bracket around the pipe and close it.

Fig. 7-14 Fastening bracket, secured around pipe

2. Assemble supporting bracket to building structure.

Fig. 7-15 Supporting bracket assembled, opened.

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

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

Fig. 7-16 Closing supporting bracket.

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

Fig. 7-17 Fully installed sound-dampening bracket.

Note: Failure to install correctly may compromise acoustic performance

Pipe support - Vertical stack

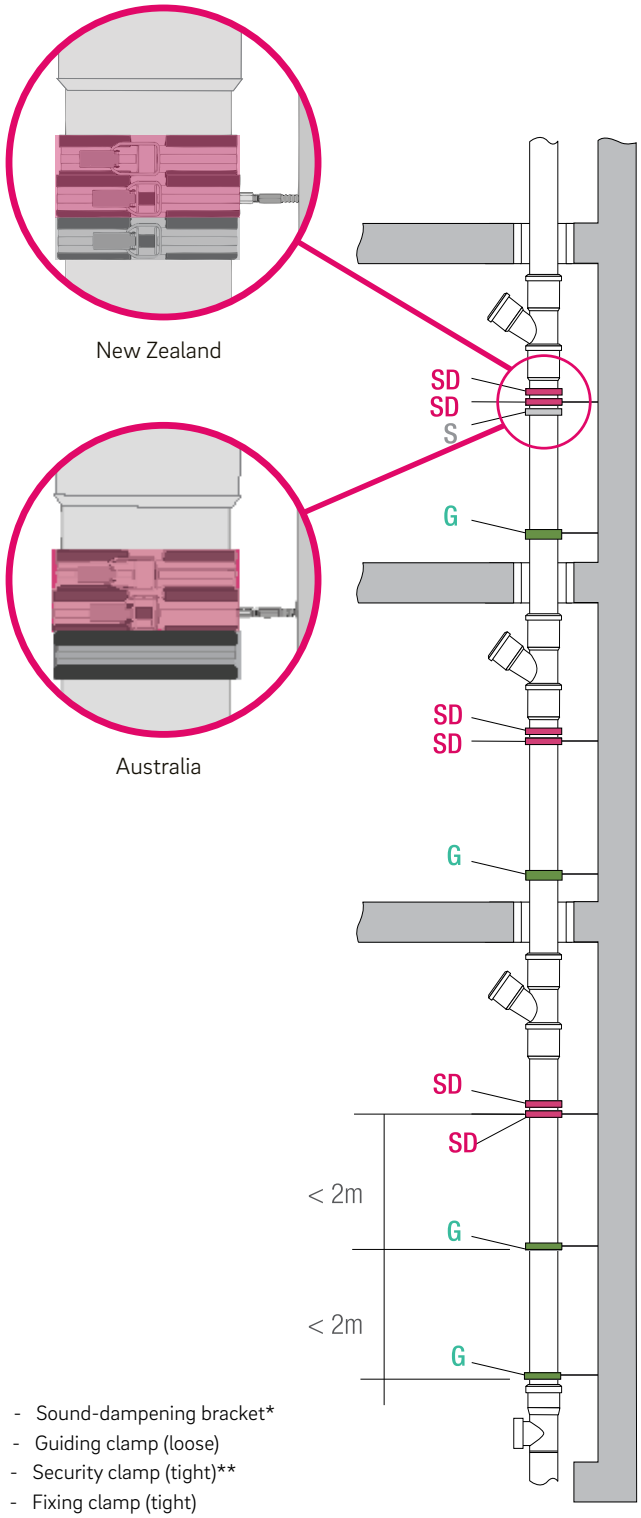
7.3.5.3 Bracketing plan for vertical stack

A plan for effective bracketing of a sound-insulating vertical stack with RAUPIANO PLUS is shown in Fig. 7-18. If a wall is not available for fixing it is acceptable to fabricate a support wall or floor/ceiling brackets that act as a firm, rigid surface, to enable attachment of vertical pipe brackets providing the bracketing configuration is followed as per section 7.3.5.

In order to ensure acoustic performance is optimised, the most important requirement for acoustically rated vertical stack installations is that the brackets that are attached to a wall / suitable fastening surface (i.e Sound Dampening support bracket and Guiding bracket) are always attached loose on the pipe.

1. **Install stack-work from bottom to top.**
2. **Install one sound-dampening bracket per floor per stack within the top quarter of the stack (ie. below the branch) or on the pipe behind the highest vertical socket.**
3. **Install one guiding bracket per floor per stack within the bottom quarter of the stack (ie. 0.5 to 1 metres above floor level).**
4. **If the distance between the sound-dampening bracket and the guiding bracket in that floor is longer than 2 metres (ie. floor height greater than 4 metres), install additional guiding bracket(s) every 2 metres.**
5. **At every 3rd floor, install a security bracket directly under the sound dampening bracket (for single dwellings only on the first storey) to prevent the vertical stack from sliding apart.**

- Although it is good practice to install the sound-dampening bracket directly below the pipe socket, it is not necessary to do so as long as it is not installed on the socket itself.
- The guiding bracket permits free longitudinal movement of RAUPIANO PLUS pipe and must be installed loose on the pipe.
- For non acoustic installations, the sound dampening bracket can be replaced with a fixing bracket.



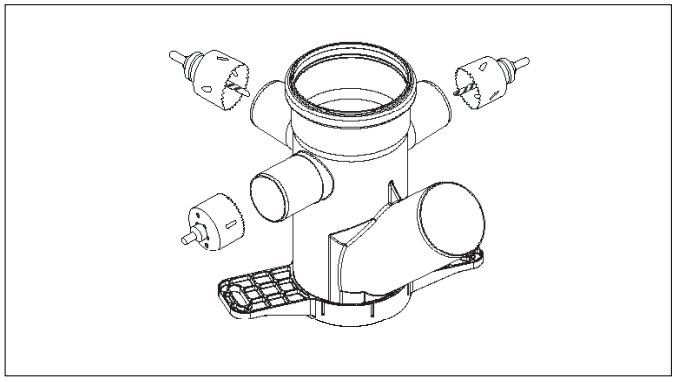
* Magenta colour for illustration purposes only. Bracket colour is black.
**Grey colour for illustration purposes only. Bracket colour is green.

Fig 7-18 Bracketing plan for vertical stack

7.4 Floor Waste Gully

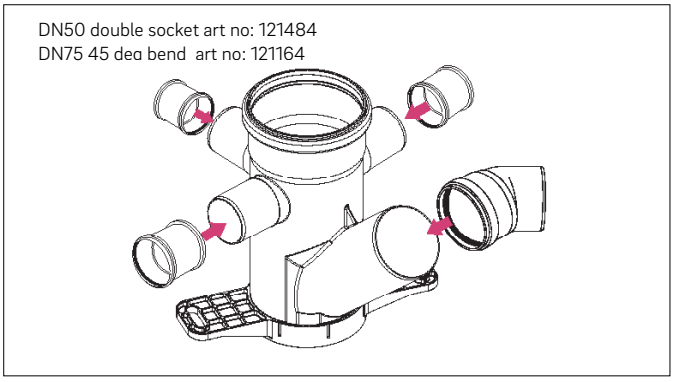
RAUPIANO PLUS - floor waste gully features:
- 3-way riser (DN 110 floor inlet, 3 x DN50 inlets, DN75 outlet).
- Integrated water seal without use of baffle.
- The same push-fit joining method applies for all the inlets and outlet.

1. Drill hole for required inlets using 44mm hole saw



Floor waste gully with supporting bracket, art. no 108971-001

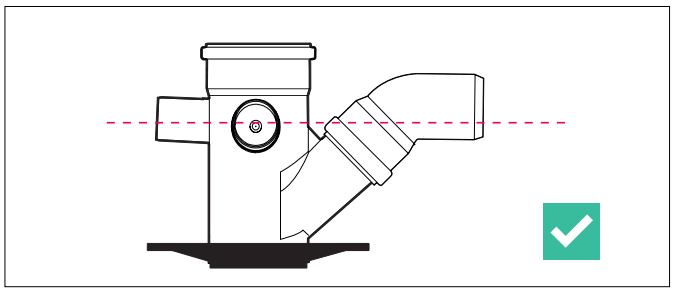
2. Assemble double socket over DN50 inlets and 45° bend over DN75 outlet*

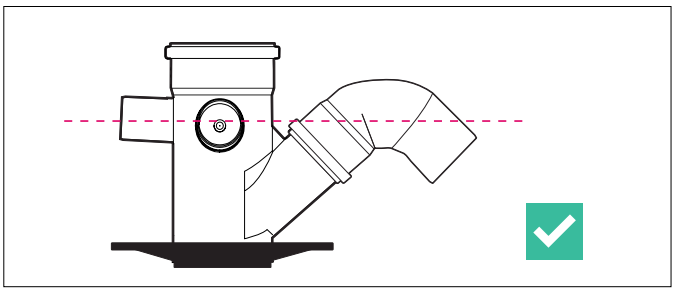


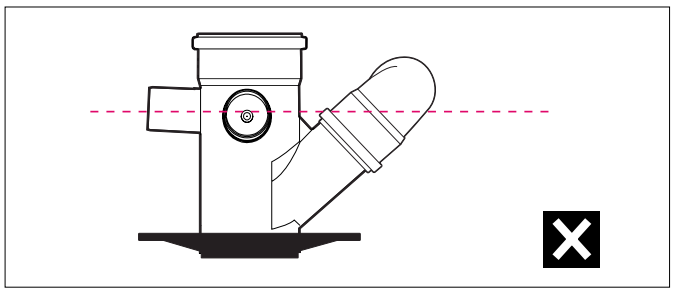
Floor waste gully with double sockets on inlets and 45° bend on outlet

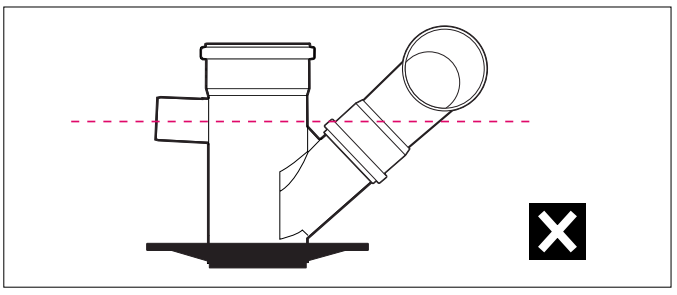
Note: Only 45° bend should be attached to DN75 outlet. If using 90° bend, it must be attached facing downwards only, and must not be attached facing sideways.

Attaching a 90° bend facing sideways will cause the outlet to be higher than the FWG inlet, preventing flow of water through the FWG. See images below.

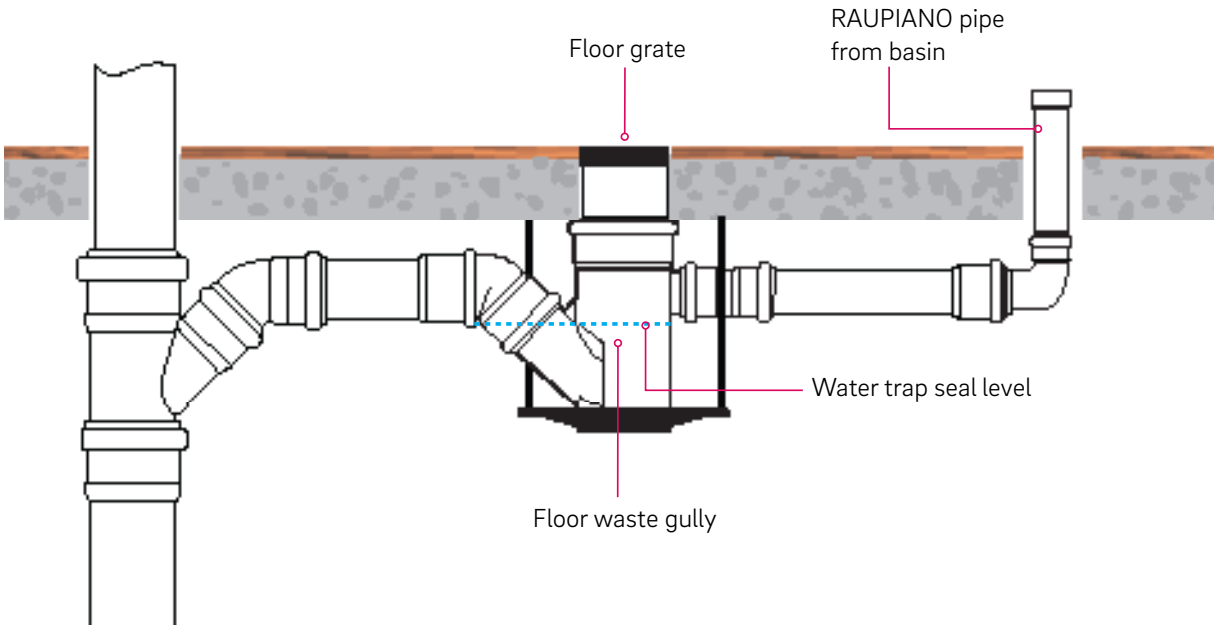








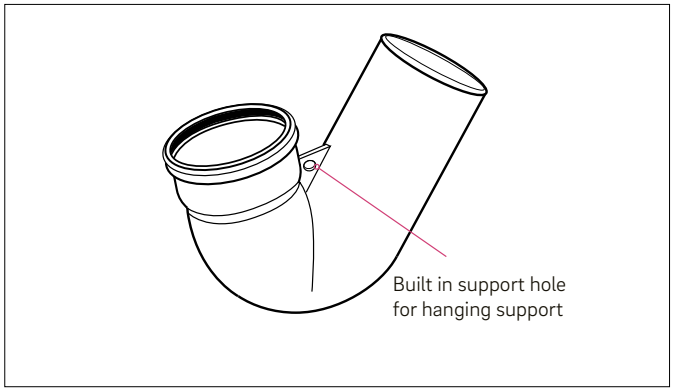
Floor Waste Gully - Bracketing schematic diagram only



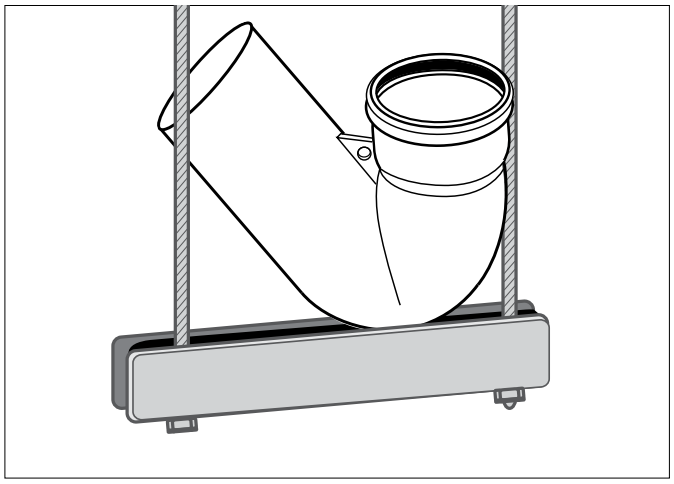
3. **Install floor waste gully beneath slab by inserting over DN110 riser pipe.**
4. **Install socket of DN75 outlet pipe over DN 75 45° bend spigot.**
5. **Install DN50 inlet pipe into double socket of each inlet to be used.**
6. **Secure floor waste gully to slab using threaded rods with bottom bracket.**

This schematic shows a general example of connecting the Floor Waste Gully's bracket to the concrete slab only, and is not intended to satisfy the installation requirements for any particular project. Fire collars, puddle flanges and other necessary components are not depicted in this schematic, but normal requirements for these remain. Normal requirements to hold the pipework in place also remain. For the installation of the Floor Waste Gully and RAUPIANO PLUS waste water piping system, national and local codes, rules and regulations, as well as local conditions and the demands of the end use customer, and REHAU's RAUPIANO PLUS Technical Information available on www.rehau.com.au need to be considered.

7.5 P-trap siphon / 110mm disconnector gully



If bracketing at the built-in support hole is not possible due to space constraints, the P-trap can be supported from below by using a rubber-lined bracket at the bottom. Vertical rods are used to connect the bracket to the concrete slab above. Please see image below as an example.



This image is purely for illustrative purposes and is not intended to satisfy the installation requirements of any particular project.

This image does not depict other components commonly installed with the P-trap."

The P-trap siphon can be supported by attaching a hook or suitable nut clip for 10mm threaded rod into the built-in support hole.

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

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

7.6 Cleaning the waste pipe system

Fig. 7-24 RAUPIANO PLUS I.O. access pipe.

Installing access pipes enables cleaning of the waste pipe system.

- RAUPIANO PLUS I.O access pipes are supplied with an insert to make the opening surface flush with the pipe inner diameter.
- The access cap has a threaded connection.
- The installation locations of inspection openings shall adhere to AS/NZS 3500.2.
- IO access pipes cannot be used to rise to surface.
- If this is required, use a DN110/87 deg junction.

Do not use sharp cleaning devices for mechanical cleaning. Pressurised water cleaners are recommended. The use of pressurised air is not recommended for clearing blockages. If these type of devices are used the user must ensure the maximum pressure rating of the system is not exceeded to ensure leaks do not occur.

Some cleaning products can contain high levels of harmful chemicals. Refer to the Chemical Resistance section in Chapter 13 for further information.

7.7 Socket plug

Fig. 7-25 RAUPIANO PLUS socket plug.

Fig. 7-26 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 joint. The securing clip is manufactured from galvanised steel.

7.8 Installing pipes in masonry

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

- Construct wall chases and penetrations 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:

- Fully wrap pipes and fittings with flexible material such as a closed cell, non-absorbent lagging to prevent sound bridges between pipe and plaster/masonry.
- In locations where temperatures above 90°C may be reached due to external heat sources, protect pipes and fittings with appropriate measures to avoid excessive heat.

7.9 Installing pipes and fittings in concrete

RAUPIANO PLUS pipes and fittings have WaterMark certifications to AS/NZS 7671:2010 and AS/NZS 5065:2005 (WM 70060 and WM 71503 respectively) and are only approved for installation within a concrete structural element (such as a structural slab, beam, column, concrete wall or loadbearing brickwork) if specifically included in the design of the structural element. This approval shall be provided by a structural engineer. During the project design phase, consult with a structural engineer on the required slab thickness and cover thickness for the appropriate loading of the slab.

In addition, AS NZS 3500.2 requires all pipes and fittings encased in concrete to be wrapped with an impermeable flexible sheath not less than 6 mm thick.

The following steps need to be taken:

- The pipes are to be appropriately fixed to prevent any movement during concrete pouring
- Pipes longer than 500mm shall be inserted into the socket fully and then pulled out 10mm to ensure that expansion of the pipe is accounted for.
- If there is no acoustic requirement, pipes shall be inserted fully into the socket.
- Fittings shall always be inserted fully into the socket.
- Seal off any pipe openings with socket plugs and conduct hydrostatic test prior to concrete pouring.
- Leave the water inside the pipeline during and at least 24 hours after the concrete pour for the following reasons:
  - To enhance the strength of the pipe structure against the force from concrete pour
  - To enable easy visual checking for any leakage within the concealed pipeline

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.

7.10 Ceiling penetrations

Ceiling penetrations must be constructed to be moisture-proof and sound-insulating as per BCA requirements. Fire-protection measurements are necessary if pipes penetrate through fire-rated building elements. Refer to chapter 5 for details.

If mastic asphalt is to be applied to the floor:
Protect exposed pipeline components with ceiling liner, protective sleeves or by wrapping them with heat-insulating materials.

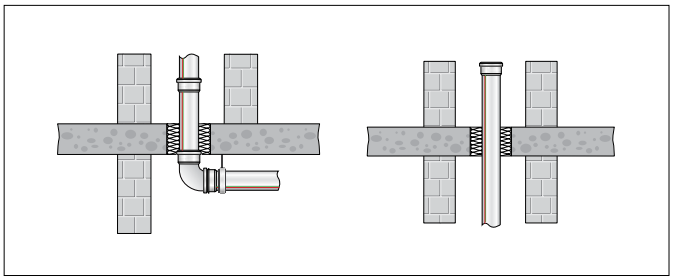


Fig. 7-27 Typical ceiling penetration through non-fire rated building elements (General example only)

7.11 Managing condensation

RAUPIANO acoustic data is not applicable for Stormwater application.

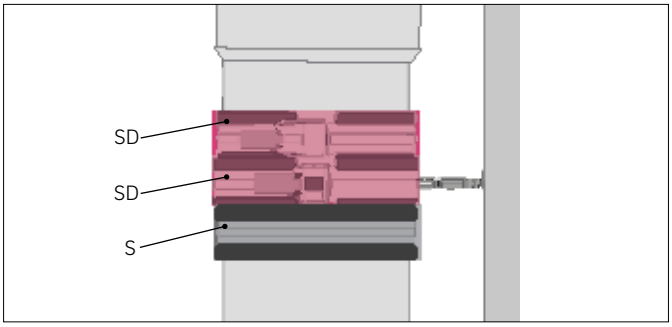
Condensation in stormwater

There is a risk of condensation on pipes installed as stormwater piping within the building. It is recommended to wrap all pipework where condensation could occur with closed-cell polymer insulation materials.

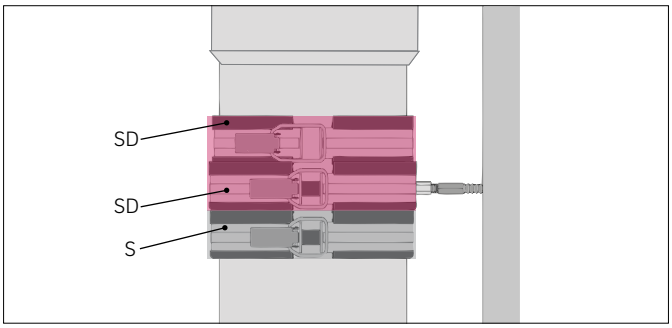
Condensation appears when the temperature of the pipe walls drops below the dew point temperature of the ambient air due to cold rain water, for example. Humidity from the ambient air then condenses on the pipe surface.

It is recommended to wrap all pipework where condensation could occur with closed-cell insulation materials.

Fixing of stormwater piping
As with all installations, to prevent the pipelines from sliding apart, a security bracket is to be attached to the pipe directly below the sound-dampening bracket on every third floor for each stack.



Fixing of stormwater piping (AUS)



Fixing of stormwater piping (NZ)

SD Sound-dampening bracket

S Security bracket (tight, not fixed to wall)

All joints in stormwater must have a pushfit lock installed, except for the highest vertical section above the last connection that continues to open air on the roof. As such the maximum pressure for stormwater applications is 2 bar and the maximum height of the stormwater system is 20m.

7.12 RAUPIANO Push-Fit Lock

The RAUPIANO Push-Fit Lock increases the socket joint integrity by preventing the pipe from being pulled-out of the socket at higher load.

Push-Fit Lock Application

1. Stormwater Downpipe installed inside buildings up to a maximum pressure of 2 bar (20 m).
2. Connection of Pump stations up to a maximum pressure of 2 bar
3. As an alternative solution, the Push-Fit Lock can be used to secure the socket plug, it would be used in replacement of using a securing clip.

Fig. 7-29 Push-Fit Lock assembled on a socket

For Pump station applications, it is required to install the Push-Fit Lock around all sockets in horizontal and vertical pipework where the applied pump pressure may exceed 1 bar.

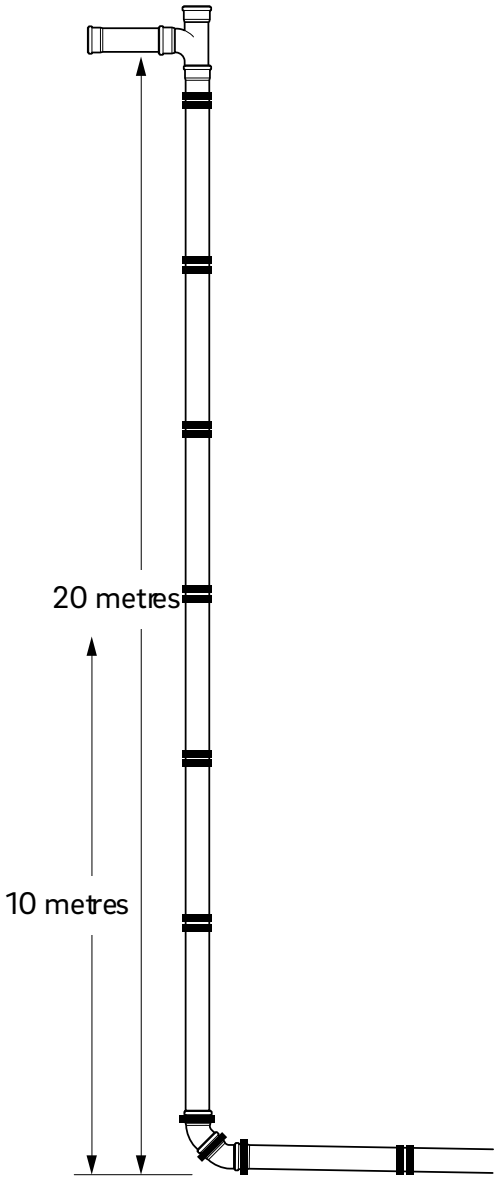
In drainage applications it is recommended to install the Push-Fit Lock around all sockets in graded and vertical pipework in buildings of more than 10m in height.

In addition, the Push-Fit Lock can also be used to prevent the pipe from sliding apart during installation phase.

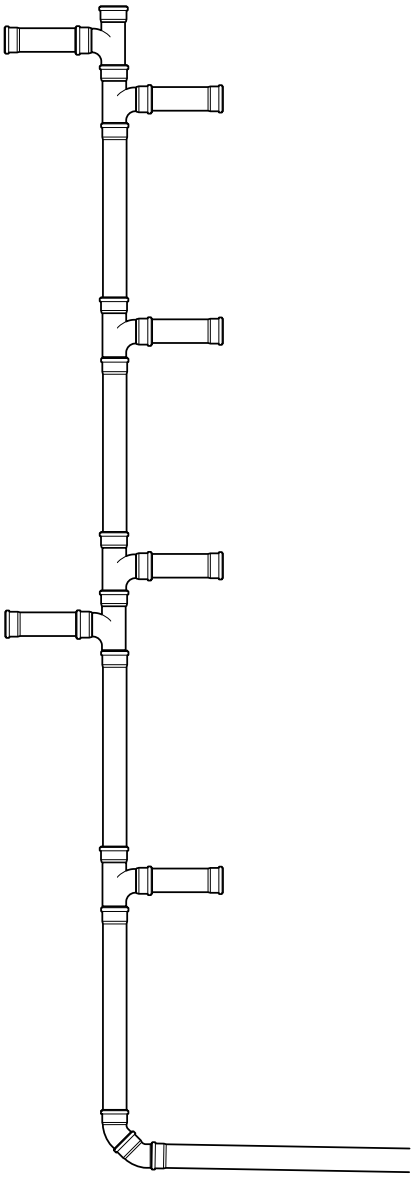
It is easily installed and dismantled. The auto-locking assembly mechanism prevents it from falling off the pipe, even when the Push-Fit Lock has not been tightened yet.

Installation is simple, fast and secure. The necessary bolts and nuts are supplied together with the Push-Fit Lock.

Required



Not required



In drainage or stormwater applications, where there are NO branches, takeoffs or balcony drains and the effective stack height is between 10 - 20 metres, Push-fit locks must be installed in both horizontal and vertical pipework, up to the first takeoff or balcony drain.

08 Installation below ground

RAUPIANO PLUS is suitable for installations below ground in sizes DN110 and above in line with AS/NZS 5065, inside and outside the building structure. The installation is to be carried out in accordance with the static requirements.*

Other applicable standards/test certificates
The following standards are to be observed when installing RAUPIANO PLUS:
- National Construction Code
- New Zealand Building Code
- AS/NZS 5065
- AS/NZS 3500
- AS/NZS 2566.2

8.1 General

Generally applicable pipeline construction rules are to be followed. Careful and professional handling of the pipes and fittings during transport, storage and laying must be ensured. Only plumbers who carry a recognised plumbing certificate for Australia or New Zealand should be installing the pipework

§ **Observe the following:**
- Accident prevention regulations of the employers' liability insurance
- Road traffic regulations
- Any special project-dependent regulations
- Applicable requirements contained in the regulations or technical regulations

8.2 Pipe trench

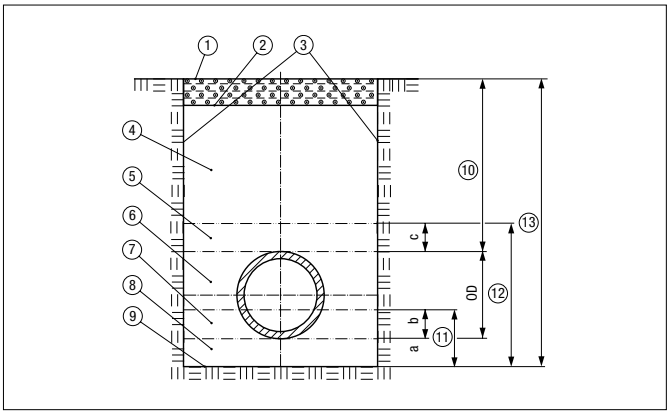


Fig. 8-1 Schematic structure of pipe trenches

1 Surface
2 Bottom edge of street or sliding construction (if present)
3 Trench walls
4 Main filling
5 Cover
6 Side filling
7 Top bedding layer
8 Bottom bedding layer
9 Trench bottom
10 Covering height
11 Thick bedding
12 Thick embedment
13 Trench depth
a Thick lower intermediate bedding layer
b Thick top bedding layer
c Thick cover
OD Outer diameter pipe

Pipe trenches must comply with AS/NZS 3500.2 and AS/NZS 2566.2. NOTE:
- Ensure the structural integrity of the trench either via suitable shoring (joists) or other suitable measures.
- Prepare trench bottom according to the required gradient.
- Make suitable recesses in the bottom pipe bed layer at the pipe connection points or in the trench bottom so that the entire length of the pipe makes contact.
- Ensure a consistently level lie of the pipelines.
- Protect trench bottom from the effects of frost.
- In high altitude and cold climates, do not use snow, ice or frozen soil above or below the pipelines.
- Remove trench shoring materials according to the static calculations so that the pipeline is neither damaged nor repositioned.

* Static calculations must be conducted in order to quantify that mechanical loading on the RAUPIANO PLUS pipe will be avoided at all times. Drains constructed with less than minimum cover shall comply with Clause 3.7 of AS/NZS 3500.2.

8.3 Embedment

The embedment of the pipe installed in ground is comprised of the:

- Pipe bedding
- Side support
- Pipe overlay
- Backfill

Ensure that the embedment is created carefully, as it is the main determining factor in the supportive capacity of the pipe.

Bedding, sidefilling and initial backfilling shall be carried out in accordance with the design and specification. The embedment should be protected against any foreseeable change of its load bearing capacity, stability or position that could be caused by removal of sheeting, groundwater influences or other excavation work. When parts of a pipeline need anchoring or strengthening, this shall be done before placement of the embedment. During placement of the embedment special attention should be given to the following:

- avoidance of displacement of the pipeline from line and level;
- care for placement of upper bedding to ensure that the voids under the pipe are filled with compacted material.

8.3.1 Bedding Materials

Embedment materials must comply with the design specifications. This can also be the excavated soil, whose suitability has been checked.

When selecting embedment materials and their grain size, observe the following:

- Pipe diameter
- Pipe material
- Pipe wall thickness
- Soil characteristics

Embedment materials must comply with requirements stated in AS/NZS 3500.2 - Clause 5.4 and AS/NZS 2566.2.

8.3.2 Pipe bedding

The pipe bedding is comprised of a bottom bedding layer, a pipe side support layer and a top bedding layer. The width of the pipe bedding must match the trench width.

AS/NZS 3500.2 - Section 5.4 Bedding of Drains and Backfilling must be complied to. The following are the manufacturers recommendations for RAUPIANO PLUS pipes installed below ground.

Location	Minimum depth of cover (mm)
Subject to heavy vehicular traffic	N/A
Subject to light vehicular traffic	500*
Elsewhere	300*

Table 8-1 Minimum depth of cover for RAUPIANO PLUS

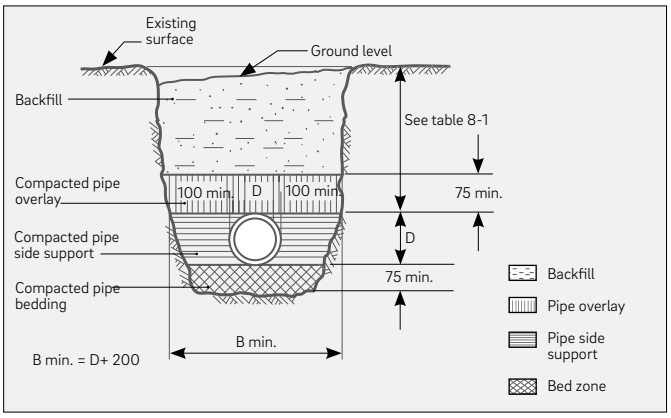


Fig. 8-2 Recommended bedding of drains

Special pipe bedding or support construction type

Any localized quantity of soft ground below trench bottom shall be removed and replaced with suitable bedding material. If more extensive quantities are encountered a re-evaluation of the structural design should be undertaken.

NOTE:
Very soft or expansive clays, irregular or fragmented rock, and saturated soils, are unsuitable pipe beddings and should be avoided. Where avoidance is impracticable, most of these situations may usually be overcome by adequate drainage of ground water, and removing the unsuitable material and replacing it with compacted embedment material.

* Static calculations must be conducted in order to quantify that mechanical loading on the RAUPIANO PLUS pipe will be avoided at all times. Drains constructed with less than minimum cover will be required to fulfill Clause 3.7 of AS/NZS 3500.2.

8.3.3 Filling

To prevent surface settling, side and main filling are to be put in place in accordance with the design requirements.

8.3.4 Compacting

The degree of compacting must correspond to the requirements for the pipeline according to the static calculation. The degree of backfilling must comply with AS/NZS 3500.2 - Section 5.5

- If necessary, compacting of the cover must be carried out by hand directly over the pipe.
- Mechanical compacting of the main filling cannot be carried out until a layer that is at least 30 cm thick is in place over the pipe apex.
- Selection of the compacting equipment, the number of compacting runs and the layer thickness to be compacted must be appropriate for to the material to be compacted and the pipeline.
- Compacting the main or side filling via silting is only permissible in exceptional cases with suitable cohesionless ground.

8.4 Connections to pipes and manholes

Connections to pipes and manholes shall be made by using prefabricated elements. Compatible junctions, connection fittings or saddle fittings may be used. The connection shall be made in accordance with the installation instructions of the manufacturer of the prefabricated elements, and shall be leaktight.

8.5 Expansion joints in ground

For pipes installed in ground it is not required to pull the pipe end out by 10mm to provide an expansion joint, refer to chapter 7.2.

09 Adaptation to drainage systems

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

- apply primer and solvent cement to the PVC side 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 into RAUPIANO PLUS socket

PVC adaptors are not approved for use in applications that exceed 60°C, including trade waste applications.

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 40/40	DN 40	40	DN 40	43
DN 50/40	DN 50	50	DN 40	43
DN 50/50	DN 50	50	DN 50	56
DN 75/50	DN 75	75	DN 50	56
DN 75/65	DN 75	75	DN 65	69

Table 9-1 Available adaptor sizes from RAUPIANO PLUS to PVC system
* For RAUPIANO sizes DN 110 and DN 160 a PVC adaptor is not required as they have the same OD as PVC.

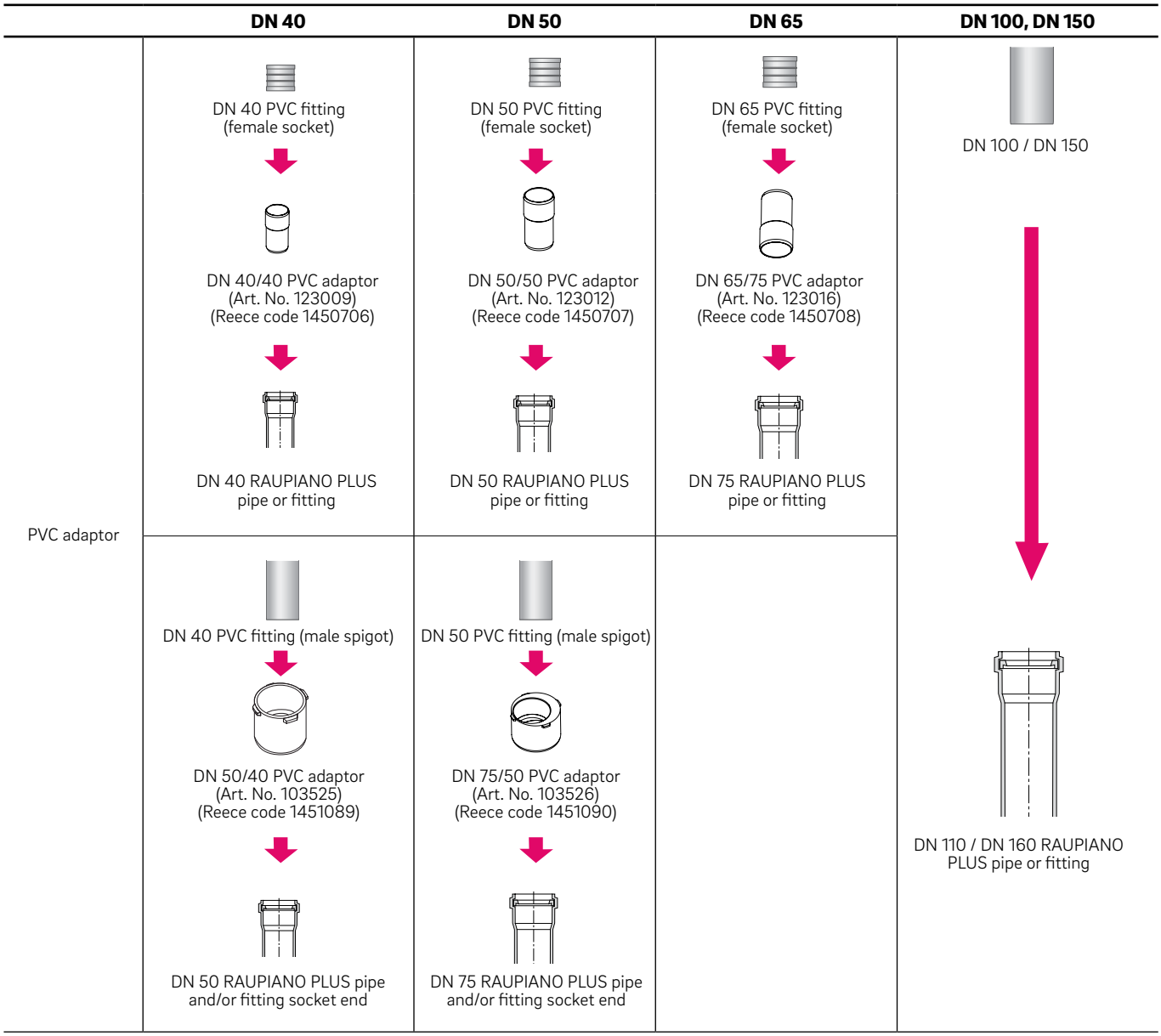


Table 9-2

9.2 Drainage fittings to RAUPIANO PLUS

There are several options for connecting plumbing fixture drainage fittings or other pipe materials to RAUPIANO plus drainage pipes or fittings:

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

RAUPIANO PLUS connection pipe

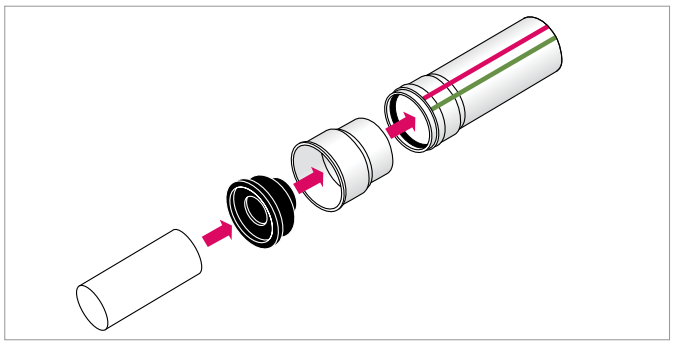


Fig. 9-1 RAUPIANO PLUS connection pipe with rubber nipple.

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 male end of drain fitting of plumbing fixture into the rubber nipple.

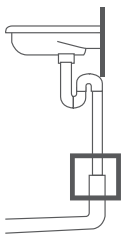
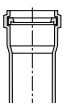
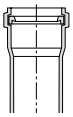
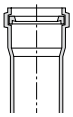
	DN 40	DN 50	DN 50
Fixture trap 	 OD 32 - 40 mm metal or plastic pipe  DN 50/40 rubber nipple (Art. No. 126253) (REECE code 1450882)  DN 40/40 connection pipe (Art. No. 123164) (REECE code 1450752)  DN 40 RAUPIANO PLUS pipe or fitting	 OD 32 - 40 mm metal or plastic pipe  DN 50/40 rubber nipple (Art. No. 126253) (REECE code 1450882)  DN 50/40-30 connection pipe (Art. No. 121414) (REECE code 1450753)  DN 50 RAUPIANO PLUS pipe or fitting	 OD 47 - 50 mm metal or plastic pipe  DN 50/50 rubber nipple (Art. No. 121913) (REECE code 1450883)  DN 50/50 connection pipe (Art. No. 121424) (REECE code 1450754)  DN 50 RAUPIANO PLUS pipe or fitting

Table 9-3 Drainage fittings to RAUPIANO PLUS adaption

RAUPIANO PLUS fitting with beaded rubber nipple

1. Remove the existing seal ring from the RAUPIANO pipe or fitting socket.
2. Insert rubber nipple with bead into the fitting socket.
3. Insert male end of the drain fitting of plumbing fixture into the rubber nipple.

For more connection from other pipe system to RAUPIANO PLUS, for example from metal/plastic P- or S-trap.

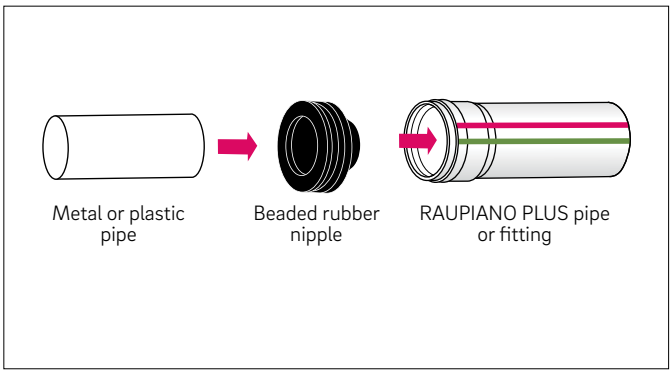


Fig 9-2

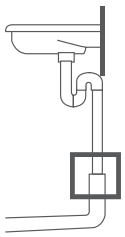
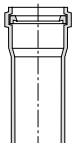
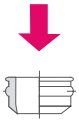
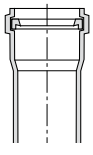
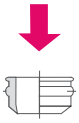
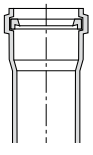
	DN 40	DN 50	DN 50
Fixture trap 	 OD 32 mm metal p or plastic ipe  DN 40/30 rubber nipple with bead (Art. No. 122923) (REECE code 1450884)  DN 40 RAUPIANO PLUS pipe or fitting (without rubber ring)	 OD 32 mm metal or plastic pipe  DN 50/30 rubber nipple with bead (Art. No. 122933) (REECE code 1450885)  DN 50 RAUPIANO PLUS pipe or fitting (without rubber ring)	 OD 40 mm metal or plastic pipe  DN 50/40 rubber nipple with bead (Art. No. 122943) (REECE code 1450886)  DN 50 RAUPIANO PLUS pipe or fitting (without rubber ring)

Table 9-4 Drainage fittings to RAUPIANO PLUS adaption

9.3 Rubber sleeve adaptor for Cast Iron pipe or other materials

Fig. 9-3 Rubber sleeve for same or different outer diameters.

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.

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 (Newton metres)
Pressure resistance	1 bar
Chemical resistance	pH 2 - 12

Table 9-5 Properties of rubber sleeve adaptor.

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.

	OD 40 mm pipe (plastic/ metal)	OD 53 - 63 mm pipe (plastic/metal)	OD 75 - 89 mm pipe (plastic/metal)	OD 100 - 115 mm pipe (plastic/metal)	OD 40-56mm metal pipe
From metal or other plastic pipe	*DN 50/40 rubber adaptor (REECE code 1430720)	DN 50/53-63 rubber sleeve adaptor (Art. No. 125024) (REECE code 1450894)	DN 75/75-89 rubber sleeve adaptor (Art. No. 125034) (REECE code 1450895)	DN 110/110 rubber sleeve adaptor** (Art. No. 123914) (REECE code 1450897)	*Reducing adaptor 40-56mm (REECE code 1430938)
	DN 50 RAUPIANO PLUS pipe (plain)	DN 50 RAUPIANO PLUS pipe (plain)	DN 75 RAUPIANO PLUS pipe (plain)	DN 110 RAUPIANO PLUS pipe (plain)	DN 110 RAUPIANO PLUS pipe plain

Table 9-6 Metal and other pipe to RAUPIANO PLUS adaption

* Fits inside pipe
**Contact REHAU for further information

10 Leak test

§ The leak test must be carried out in accordance with AS/NZS 3500.2

For pipes installed below ground, testing shall be conducted prior to the placement of the trench fill (backfill).

10.1 Hydrostatic test

Where there are water restrictions or the network provider has a water management strategy, hydrostatic testing may not be permitted, in which case an air or vacuum seal test must be conducted. In accordance with section 13 of AS/NZS 3500.2

The sanitary plumbing and sanitary drainage shall be filled with water -
(a) in the case of sanitary drainage, to a height of not less than 1m above the pipe soffit level at the highest point of the section being tested;
(b) in the case of sanitary plumbing, to the spill level of the highest fixture or to the flood level of the lowest sanitary fixture, whichever is higher; and
(c) in the case of pipe installed below ground, to a height not less than 2 m (or 20 kPa) above the pipe soffit level at the highest point of the section being tested or 2 m (or 20 kPa) above ground water table, whichever is the greater.

The pressure shall be maintained without leakage for at least 15 min. The source of any leak shall then be ascertained and any defects repaired. The section under test shall then be retested.

* Various air test pipe bungs are available.

10.2 Air Test

Alternatively, the test can be carried out with air.

The air test is carried out with:
- Test pressure 15 kPa

1. Ensure firm and sealed seating of plugs.
2. Pressurise the system and stabilize for a minimum of 3 minutes while checking for leaks
3. After pressure is stabilized commence the test by allowing the pressure to reduce to 10 kPa
4. Start test time and record drop in pressure during the test time
5. The section of sanitary plumbing or sanitary drainage being tested shall not have a drop in pressure greater than 3 kPa over the minimum test duration specified in Table 10.1

Pipe size	Test Length (m)					
	50	100	150	200	250	300
DN	Minimum test duration, min					
110	2	2	2	2	3	3
160	3	3	3	6	6	6

Table 10-1 Minimum test duration for Air Test in minutes

* Ensure all open ends are secured to prevent pipe caps from blowing off during air test.

11 Certifications and test reports

Australia

New Zealand

RAUPIANO PLUS and other REHAU product Watermark Certificates are available for download from **www.rehau.com.au/raupiano** Please be advised that the REHAU PVC Adaptors have Best Environmental Practice Certification and the certificate is available for download from the above link.

12 Technical specifications

Material	PP-MD mineral-reinforced (pipes and fittings)	
Size range	DN 40 – DN 160	
Area of application	Waste water pipes in buildings and laid below ground inside and outside the building structure	
Chemical resistance	Polypropylene basis No waste water containing benzene Seals made of EPDM	in accordance with DIN 8078 DIN 4060, DIN EN 681-1
Application	Waste water with ph value 2 – 12 Waste water temperature up to 98°C for brief periods (refer to section 2.1.3 for further information) Maximum head pressure 1 bar (10m) respectively 2 bar (20m) when using Push-fit Lock Design Service Life 50 years within these application parameteres	
Product warranty	10 years	
Density of pipe	1.9 g/cm^3	
Coefficient of thermal expansion	0.09 mm/m·K	DIN 53752
Ring stiffness	> 4 kN/m^2 (SN 4)	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
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 with smooth internal wall Fittings - Mass optimisation in redirection area for increased sound insulation	 DN 110 – DN 160
Halogen contents	Halogen-free (no F, Cl, Br, I)	
Connection	Push-fit socket with factory-installed lip sealing ring	
Fire behaviour	B2 (Normal Flammability)	In accordance with DIN 4102
	D-s2, d0	In accordance with EN 13501-1
System compatibility	Adapters to PVC system and other pipe materials are available	
Standards and approval	System test according to: - AS/NZS 7671, WM70060 - AS2887, WM71501 - AS/NZS 1260, WM71502 - AS/NZS 5065, WM71503 System assessed according to: - BRANZ Appraisal No. 809 - Best Environmental Practice PVC to AS/NZS 1260	
Sound insulation	Tested to ISO 140 methodology. Sound insulation performance rated according to ISO 717 Fulfils 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. 11-1 Technical specifications.

13 Chemical resistance

13.1 General Information

For piping systems, the chemical resistance of the materials of the system is only one factor that confirms the lifetime of the system. Other factors that can contribute to faster deterioration of the system must be considered as the deleterious effects of the chemicals can be increased when considering the combination of the chemical effect with the following key factors:

- Temperature of the waste water over the installed lifetime
- Duration of exposure to chemicals in waste water over the installed lifetime
- Mechanical loading of the system.

The following information is general in nature and is related to the lifespan of the system. It shall not be used as a guidance to determine the possible effects of the chemical on the system. It is the responsibility of the installer / designer to ensure all factors of the particular application are considered in combination with this general chemical resistance advice.

The system shall be installed free of mechanical load as this can be detrimental to the system when combined with the effects of exposure to chemicals and high temperature. As such, the following information does not consider the combined effect of chemical exposure and temperature with mechanical loading.

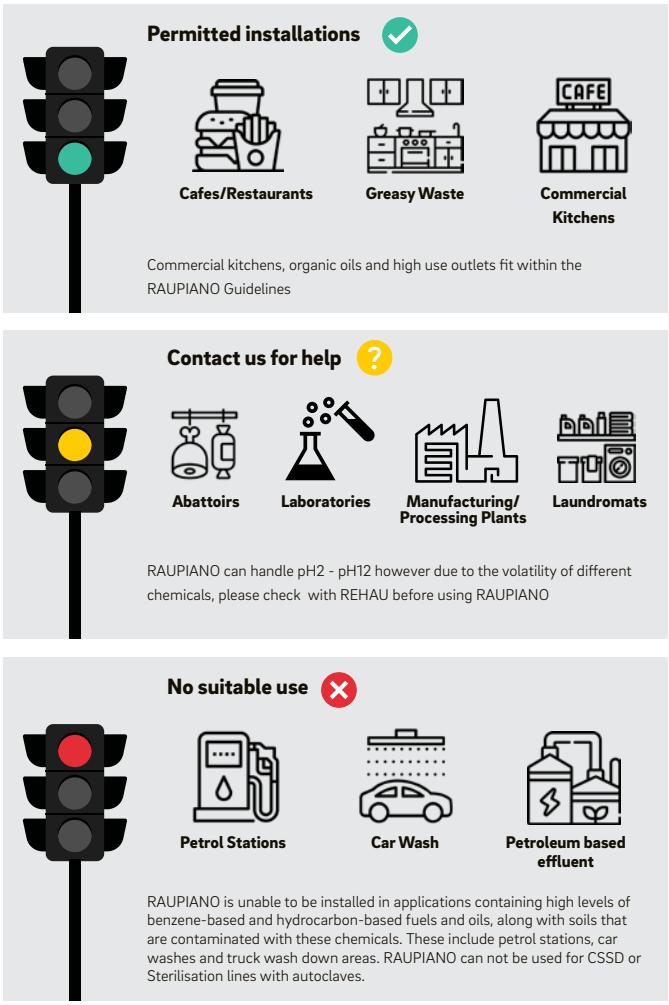
If in doubt, it is recommended to test the suitability of the pipe, fitting and seal material through testing.

13.2 Determining chemical resistance:

Refer to the traffic light guide in Section 13.2.1 to verify which category your application belongs to and follow the relevant instructions.

If your application comes under the orange light, refer to Section 13.2.2 for instructions on using the chemical resistance table to determine resistance as a preliminary check, and contact REHAU.

13.2.1. RAUPIANO Traffic Light Guide



13.2.2. Determining chemical resistance

The following chemical resistance rating is for standard system components (being pipes and fittings) with standard integrated seal rings when exposed to the noted chemical at the noted temperature and concentration when drained with water, or otherwise when rinsed with water after draining. For adapters and other system components, please contact REHAU for advice.

Acceptable chemical resistance is established by following the below instructions:

1. Confirm that the drainage duration of the chemical(s) being drained is within the system temperature profile in table 2-1.

2. Refer to the below table to check the chemical resistance rating for the chemical(s) being drained. "Yes" means that the chemical is approved to be drained at the specified temperature and concentration only, either with water or rinsed with water after draining. "No" means that the chemical is not approved to be drained at the specified temperature and concentration.

Fill in the Trade Waste approval form and submit to REHAU if you encounter the following scenarios:

- Chemical resistance is described as "Limited"
- Drainage concentration and temperature are different to that mentioned in the table
- Chemical is not listed in the chemical resistance table

13.5 Chemical Resistance Table

Medium	Concn., %	Temp. °C	System Comatibility
Acetaldehyde	10	20	Yes
Acetamide	5	60	Yes
Acetic acid	10	50	Limited
	25	50	No
	50	100	No
Acetic anhydride	10	20	Limited
Acetone	10	20	Yes
Acetophenone	10	20	Yes
Acrylonitrile	10	50	Limited
Air		60	Yes
Aluminium nitrate	10	20	Yes
Ammonia, aqueous	Sat	23	Yes
Ammonia, dry gas	10	23	Yes
Ammonia, wet gas	10	20	Yes
	10	Hot	Limited
Ammonium carbonate	Sat	70	Yes
Amyl acetate	10	20	Limited
Amyl alcohol	10	50	Yes
Aniline	Sat	23	Limited
Aniline hydrochloride	Sat	20	Limited
Arsenic acid	10	20	Yes
Barium chloride	10	20	Yes
Barium sulfate	10	20	Yes
Benzaldehyde	0.1	60	Yes
Benzene	10	20	No
Benzyl alcohol	10	23	Yes
Benzyl chloride	10	20	No
Boric acid	Diluted	80	Yes
	Diluted	100	Limited
Butadiene, gas	10	23	Limited
Butanediol	10	23	Yes
n-Butanol	10	40	Yes
Butyl acetate	10	23	Limited
Butyl glycol	10	20	Yes
Butylphenol	Sat	20	No
Butyric acid	10	20	Limited
Calcium (metal)	10	20	Limited
Calcium carbonate	10	20	Yes
Calcium hydroxide	10	20	Yes
Calcium hypochlorite	10	20	Limited
Carbon dioxide, dry gas	10	20	Yes
Carbon disulphide	10	20	No
Carbon monoxide, gas	10	80	Yes

Medium	Concn., %	Temp. °C	System Comatibility
Carbon tetrachloride	10	20	No
Castor oil	10	60	Yes
Chlorine, dry gas	10	20	Limited
Chlorine water	Sat	20	No
Chloroacetic acid	10	20	Limited
Chlorobenzene	10	20	No
	10	50	No
Chlorobromo- methane	10	20	Limited
Chloroform	10	20	No
Chlorosulphonic acid	10	20	No
Chromic acid	40	50	Limited
Citric acid	Sat	70	Yes
Copper (metal)	10	20	Yes
Copper chloride	10	20	Yes
Copper nitrate	10	20	Limited
Copper sulfate	10	20	Yes
Cresylic acid	Sat. sol (approx. 2-3%)	70	Limited
Crotonaldehyde	10	20	Yes
Cyclohexane	10	20	No
Cyclohexanol	10	20	No
Cyclohexanone	10	20	Limited
Diacetone alcohol	10	20	Limited
Dichlorobenzene	10	20	No
Diethylamine	10	20	No
Diethylene glycol	10	60	Yes
Dimethylamine	10	23	Limited
Dimethyl- formamide	10	23	Limited
Dioctyl phthalate	10	60	Limited
Ethanol	10	50	Yes
Ethanolamine	10	20	Yes
	10	70	Limited
Ethyl acetate	10	20	Limited
Ethyl acrylate	10	23	Limited
Ethyl chloride, gas	10	20	No
1,1 Ethylene dichloride	10	23	Limited
Ethylene glycol	10	60	Yes
Ethylene oxide	10	100	Limited
Ferrous sulfate	10	20	Limited
Fluoboric acid (dec. at 130°C)	10	20	Yes

Medium	Concn., %	Temp. °C	System Comatibility
Fluosilicic acid	50	23	Limited
Formic acid	10	20	Limited
	10	70	Limited
Freon 12	10	20	Limited
Freon 22	10	20	Limited
Gas, natural, dry	10	20	No
Gelatine	10	40	Yes
Glucose (dec. at > 200°C)	10	60	Yes
Glycerine	10	23	Yes
Glycolic acid	37	20	Limited
Hexane	10	20	No
1-Hexanol	10	20	Limited
Hydrobromic acid	37	23	Yes
Hydrochloric acid	10	100	No
	21	50	Limited
	37	23	No
Hydrocyanic acid	20	20	Yes
Hydrofluoric acid	48	20	Limited
	70	20	Limited
Hydrogen	10	20	Yes
Hydrogen peroxide	30	20	Limited
Hydrogen sulphide, aqueous	Sat	23	Yes
Hypochlorous acid	10	20	Limited
Iodine	10	20	Limited
Iron nitrate	10	20	Yes
Isobutyl alcohol	10	23	Yes
Isooctane	10	20	No
Isopropyl acetate	10	20	Limited
Isopropyl alcohol	10	40	Yes
Lactic acid	10	70	Yes
Lead (metal)	10	20	Yes
Lead nitrate	10	20	Yes
Magnesium metal	10	20	No
Magnesium nitrate	10	20	Yes
Maleic acid (dec. at 160°C)	Sat	20	Limited
Malic acid (subl.)	10	20	No
Mesityl oxide	10	20	No
Methane	10	20	No
Methyl acetate	10	20	Limited
Methyl bromide (bromo methane)	10	20	No

Medium	Concn., %	Temp. °C	System Comatibility
Methyl butyl ketone	10	20	Limited
Methyl ethyl ketone	10	20	Yes
Methyl methacrylate	10	23	Limited
Methylamine	32	20	Yes
Methylated spirits	10	20	Yes
Milk	10	23	Yes
Naphtha	10	20	No
Naphthalene	10	20	No
Nitric acid	10	50	Limited
	65	23	No
Nitric acid, fuming (with nitrogen dioxide)	10	20	No
Nitrobenzene	10	20	Yes
	10	50	Limited
Nitromethane	10	20	Limited
Oleic acid	10	20	Limited
Oxalic acid (subl.)	Diluted	60	Yes
Oxygen, gas	10	23	Yes
Ozone, gas	10	20	No
Perchloro- ethylene	10	20	No
Phenol	10	80	No
Phenylhydrazine (dec.)	10	23	Limited
Phosphoric acid	60	50	Yes
Phosphorus (III) chloride	10	20	Limited
Phthalic acid	Sat	23	Yes
Picric acid (subl.)	10	40	Yes
Potassium nitrate	10	20	Yes
Potassium permanganate	25	70	No
Propionic acid	10	23	Yes
Pyridine	10	20	Limited
Salicylic acid (subl.)	Sat	20	Yes
Silicone oil	10	60	Yes
Silver nitrate	10	20	Yes
Sodium bicarbonate	10	20	Yes
Sodium carbonate	20	80	Yes
Sodium chloride	Sat	70	Yes
Sodium hydroxide	25	20	Yes
Sodium hypochlorite	10	50	Limited
Stearic acid	10	70	Limited
Strontium chloride	10	20	Yes

Medium	Concn., %	Temp. °C	System Comatibility
Styrene	10	20	No
Sulphur dioxide, dry gas	10	23	Yes
Sulphuric acid	10	60	Yes
	70	20	Limited
	96	20	No
Sulphurous acid	Sat	23	Limited
Tannic acid	10	20	Yes
Tartaric acid (dec.)	10	100	Limited
Thionyl chloride	10	20	No
Toluene	10	20	No
Tributyl- phosphate	10	20	Yes
Trichloroacetic acid	10	23	Limited
Trichloro- ethylene	10	20	No
Triethanolamine	10	23	Limited
Turpentine	10	20	No
Universal Indicator	10	20	Yes
Urea	30	23	Yes
Xylene	10	20	No
Zinc	10	20	Yes

RAUPIANO PLUS
Standards, regulataions and guidelines

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 1260
PVC-U pipes and fittings for drain, waste and vent application

AS/NZS 2566.2
Buried flexible pipelines - Part 2: Installation

AS/NZS 3500.2
Plumbing and drainage
Part 2: Sanitary plumbing and drainage

AS/NZS 5065
Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

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

All schematic show general examples only and are not intended to satisfy the installation requirements for any particular project. For the installation of RAUPIANO PLUS waste water piping system, national and local codes, rules and regulations, as well as local conditions and the demands of the end use customer need to be considered.

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