Department Construction
Name REHAU Web Design New Zealand
Phone 9272 2264
Email FHDesign.ANZ@rehau.com
Date 20/02/2020

Plumbcraft
Todd Bowmast
5 Waimana Rd
Takanini 2244

**REHAU Hydronic System detailed design - Heating**

**Project: 19-113 WarmNZ- Stonedon Freezer**

Dear Todd,

We have pleasure in submitting our detailed design documents for your above mentioned project. This design and the associated data have been prepared according to the information, diagrams and/or drawings provided. Please check and confirm all parameters and results prior to using them.

By utilising our design service and the results you recognise the current REHAU Terms and Conditions of Sale, which are available on request or at www.rehau.com/LZB.

**In case this design requires amendments, please send an email with all required changes to FHDesign.ANZ@rehau.com**

Additional charges may apply for design changes or required corrections not caused by us.

We thank you for your interest in the REHAU Hydronic System detailed design and look forward to the application of our products.

Please do not hesitate to contact us if you require any further clarification or assistance.

Kind regards

REHAU Web Design New Zealand
**REHAU Pty Ltd**

Attachments:
Performance overview (proposed final)
Hydraulic Balancing Data for each manifold
Bill Of Material (proposed final)
Circuit layout as CAD drawing

# REHAU HYDRONIC SYSTEM
## DESIGN NOTES

V.8.1

| | |
|---|---|
| **PROJECT NO.** | 19-113 |
| **PROJECT NAME** | WarmNZ- Stonedon Freezer |
| **INSTALLER** | Plumbcraft |
| **DATE** | 20/02/2020 |

These design notes shall provide guidance on obviously conflicting parameters. Please read them carefully.

| | Parameter | Design Notes |
|---|---|---|
| **System Details** | Anti Freeze | The calculation is based on a ratio of 40% anti-freeze in water. It has been assumed the anti-freeze will be Ethylene Glycol with corrosion inhibitor. |
| **System Details** | Anti Freeze | When selecting anti-freeze make sure it includes corrosion inhibitors and is suitable for all metal materials used in the installation, ie. brass, steel etc. Anti-freeze with corrosion inhibitors must be maintained regularly in accordance with manufacturer's instruction. |
| **Manifold Details** | Flow Temperature Control Components | The Flow Temperature Mixer Unit requires a supply temperature from the heat source between 32ºC and 70ºC to be able to provide the required output. |
| **Manifold Details** | Flow Temperature Control Components | Further Control Components may be required for this application, check the Bill of Material and confirm the included control components suit your requirements. |
| **Control Details** | Zone Control | Further Control Components may be required for this application, check the Bill of Material and confirm the included control components suit your requirements. |
| **Performance Details** | Required Output | The target output (heat load/cooling load) reflects the information provided by the requesting party. REHAU has not verified if it covers the load requirements of the building or of particular areas of the building. We recommend to verify the load requirements by conducting a heat load / cooling load calculation. |

# REHAU HYDRONIC SYSTEM

## PERFORMANCE OVERVIEW - PROPOSED FINAL*

REHAU Unlimited Polymer Solutions

V.8.1

| | |
|---|---|
| **PROJECT NO.** | 19-113 |
| **PROJECT NAME** | WarmNZ- Stonedon Freezer |
| **INSTALLER** | Plumbcraft |
| **DATE** | 20/02/2020 |
| **DESIGN BY** | REHAU Design Team |

**Freezer (R=6.16 m².K/W)**

| Floor layer: | L (mm) |
|---|---|
| Wear Slab | 150 |
| Insulation | 200 |
| Concrete Cover | 38 |
| ------ Pipe center ------ | ----- |
| Concrete Cover | 112 |
| Sand | 2000 |

**N/A**

| Floor layer | L (mm) |
|---|---|
| N/A | |

**N/A**

| Floor layer | L (mm) |
|---|---|
| N/A | |

**HYDRAULICS**

| | | |
|---|---|---|
| Pipe type | RAUTHERM S 25 | |
| Heating Flow temp | 22 | °C |
| Cooling Flow temp | NA | °C |

**PERFORMANCE SUMMARY**

| | | |
|---|---|---|
| No. of zones | 1 | |
| No. of circuits | 5 | |
| Conditioned Area | 208.0 | m² |

| Room Parameters | | | | | | | | Heating Performance | | | | | | | | | Cooling performance | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Room(s) | Zone | Area | Room Thermostat | Floor System | Floor type | Floor Covering | Pipe spacing | Temp above/ inside | Temp below/ outside | ΔT flow/ return | Area flow rate | Floor Surface Temp | Target Heat Output | Heat output up | Heat output down | Percent Covered | Total Slab Output | Temp above/ inside | Temp below/ outside | ΔT flow/ return | Area flow rate | Floor Surface Temp | Target Cooling Output | Cooling output up | Cooling output down | Percent Covered | Total Slab Output |
| | | m² | | | | | mm | °C | °C | °C | L/min | °C | W/m² | W/m² | W/m² | % | W | °C | °C | °C | L/min | °C | W/m² | W/m² | W/m² | % | W |
| Freezer 1 | 1 | 208.0 | None | Freezer | Slab on ground | None | 400 | -18.0 | 5.0 | 3.0 | 21.4 | -17 | 6 | 6 | 13 | 105 | 3974 | | | | | | | | | | |
| | 1 | 208.0 | | | | | | | | | | | | | | | 3974 | | | | | | | | | | |

** This design and the associated data have been prepared in accordance with the information provided by the requesting party. Please check if the parameter suits to your project. For minimum insulation requirements for the floor refer to the Building Code of Australia / New Zealand Building Code. When considering to use Tacker sheet, please check that the thermal and physical properties (eg. compressive stress) suit to your project. The advice is based on experience and the most recent know how but does not represent any obligation on our part.*

### Explanatory Notes:

| | |
|---|---|
| PIPE SPACING | Proposed pipe laying distance. Laying the pipes in a different spacing will influence the performance of the system. |
| TEMPERATURE ABOVE/INSIDE | Target temperature for the conditioned area above the slab (typically "Room Temperature"). |
| TEMPERATURE BELOW/OUTSIDE | Temperature of the area below the slab (ie. ground temperature or room below). |
| ΔT FLOW/RETURN | Temperature difference between supply and return for the conditioned area. |
| NO. OF CIRCUITS | Number of circuits required to cover the conditioned area. |
| FLOOR SURFACE TEMPERATURE | Surface temperature of the finished floor. |
| TARGET HEAT/COOLING OUTPUT | Target Heat/Cooling output as per the information provided by the requesting party. |
| HEAT/COOLING OUTPUT UP | Heating/Cooling performance upwards in Watts per square meter. |
| HEAT/COOLING OUTPUT DOWN | Heating/Cooling performance downwards in Watts per square meter (in slab-on-ground constructions = "Downward losses") |
| PERCENT COVERED | Coverage of Target Heating/Cooling output in % |
| TOTAL SLAB OUTPUT | Output (upwards + downwards) of the conditioned slab in Watts. |

# REHAU HYDRONIC SYSTEM

## MANIFOLD VALVE SETTINGS - HYDRAULIC BALANCING

REHAU
Unlimited Polymer Solutions

| Project Nº: | 19-113 | | | | | Project Name: | WarmNZ- Stonedon Freezer | | | Installer: | Plumbcraft | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Manifold M1 -** | **Ground Floor** | | | | | | | | | | | | Date | 20/02/2020 |
| | | | | | | | | | | | | | | V.8.1 |

| **Circuit Fluid Properties** | | | **Circuit Pipe Details** | | **Flow and Return Pipe** | | | **R E S U L T S - Manifold** | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Heating Temperature | 22.0 | ºC | Manifold | Stainless HKV-D | Length | 30 | m | Number of circuits: | 5 | |
| Cooling Temperature | NA | ºC | Pipe | RAUTHERM S 25 | Flow/Ret pipe | RAUTITAN Pink 40 | | Total Length of circuits: | 561 | m |
| Mean water temp | 20.5 | ºC | **Mixing Unit Details** | | Flow rate | 1385 | l/h | Total Flow: | 1385 | l/h |
| % Ethylene Glycol | 40.0 | % | Type | External Flow Mixing Con | v | 0.6 | m/s | Pressure Loss @ Manifold: | 14.3 | kPa |
| viscosity | 0.0031 | Pa.s | Supply t | 22.0 ºC | ΔPf/r | 8.1 | kPa | Total pressure including F/R | 22.5 | kPa |
| | | | | | %Fitting losses | 20% | (estimate) | | | |

**I N P U T - Manifold**

**R E S U L T S - Floor Circuits**

| | | Circuit length | Flow | | | | Head Losses | | | Balancing | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Note: ** pressure drop when valves fully open!* | | | | | | | Pipe | Flow and Retun Valves | Total Loss | Turn direction: **Closed => Open** | | |
| | | Σ | v | v | Velocity | Head Loss | $\Delta p_{pipe}$ | $\Delta p_{Flow/Return\ valves,\ full\ open}$ | $\Delta p_{total}$** | | | |
| Circuit Name | No. | m | l/min | l/s | m/s | Pa/m | Pa | Pa | Pa | Pa | Kv | Turns |
| | | | | | | | | | | | m³/h | |
| Circuit | M1.1 | 113 | 4.6 | 0.077 | 0.237 | 76 | 8,602 | 5,738 | 14,340 | 5,738 | 1.16 | 8 |
| Circuit | M1.2 | 113 | 4.6 | 0.077 | 0.237 | 76 | 8,602 | 5,738 | 14,340 | 5,738 | 1.16 | 8 |
| Circuit | M1.3 | 110 | 4.5 | 0.075 | 0.231 | 73 | 7,998 | 5,437 | 13,436 | 6,342 | 1.08 | 7 |
| Circuit | M1.4 | 112 | 4.6 | 0.077 | 0.235 | 75 | 8,398 | 5,637 | 14,035 | 5,943 | 1.13 | 7 |
| Circuit | M1.5 | 113 | 4.6 | 0.077 | 0.237 | 76 | 8,602 | 5,738 | 14,340 | 5,738 | 1.16 | 8 |
| Circuit | M1.6 | | | | | | | | | | | |
| Circuit | M1.7 | | | | | | | | | | | |
| Circuit | M1.8 | | | | | | | | | | | |
| Circuit | M1.9 | | | | | | | | | | | |
| Circuit | M1.10 | | | | | | | | | | | |
| Circuit | M1.11 | | | | | | | | | | | |
| Circuit | M1.12 | | | | | | | | | | | |
| Circuit | M1.13 | | | | | | | | | | | |
| Circuit | M1.14 | | | | | | | | | | | |
| Circuit | M1.15 | | | | | | | | | | | |
| Circuit | M1.16 | | | | | | | | | | | |
| Circuit | M1.17 | | | | | | | | | | | |

# REHAU HYDRONIC SYSTEM
## BILL OF MATERIAL - PROPOSED FINAL*

V.8.1

| | | | |
|---|---|---|---|
| **PROJECT NO.** | 19-113 | **Date** | 20/02/2020 |
| **PROJECT NAME** | WarmNZ- Stonedon Freezer | **Department** | Construction |
| **INSTALLER** | Plumbcraft | | |

**PROJECT OVERVIEW:**

| | |
|---|---|
| **Project Type** | Commercial |
| **System** | in-slab |
| **Pipe** | RAUTHERM S 25 |
| **Heat Source** | Solar with gas booster |
| **Total output Heating** | 4 kW |
| **Cooling Source** | None |
| **Total output Cooling** | 0 kW |
| **Covered Floor Area** | 208 m² |
| **Number of Zones** | **1** |
| **Number of manifolds** | 1 |
| **Number of circuits** | 5 |
| **Manifold type** | Stainless HKV-D |
| **Flow Temp. system** | External Flow Mixing Control |

**Further details see page "Performance Overview"**

| Category | Sub Category | Product Description | Availability | Article Number | Units | Est. Qty | Order Quantity |
|---|---|---|---|---|---|---|---|
| Floor Systems | RAUTITAN Pink | Pipe 40 x 5.5 mm - 6m straight | Standard | 136082-006 | m | 30 | 36 |
| Floor Systems | RAUTHERM S | Pipe 25 x 2.0 mm - 300m coil | Lead Time | on request | m | 561 | 600 |
| Controls | Zone Controls | Actuator 24V for brass manifold / stainless steel manifold / NEA control | Standard | 241293 or 217916 | ea | 5 | Optional |
| Controls | Zone Controls | Actuator 230V for brass manifold / stainless steel manifold / ADR-UFH control | Standard | 241283 or 217915 | ea | 5 | Optional |
| Accessories | RAUTITAN Fittings | Polymer Profile Bend Bkt 90 Deg 25 mm | Standard | 299894-098 | ea | 10 | 10 |
| Accessories | RAUTHERM S Fittings | No. 1 Straight Coupler 25 x 2.3 mm | Lead Time | 259187-002 | ea | 2 | 2 |
| Accessories | RAUTHERM S Fittings | Compression Sleeve 25 x 2.3 mm | Lead Time | 259197-002 | ea | 4 | 4 |
| Floor Systems | Manifold | IM 40 with 5 ports | Lead Time | 1248900-001 | ea | 1 | 1 |
| Floor Systems | Manifold | Ball valve DN 40 | Lead Time | 1247830-001 | ea | 1 | 1 |

**Further Hydronic Components that may be required*:**
- Suitably sized energy source(s)
- Suitably sized supply and return pipe work from the energy source to the manifold(s)
- An external pump (check the internal energy source pump curve)
- Suitably sized expansion vessel
- Safety Valves and Isolating Valves
- Air Bleeding Valve
- Other

The above are only suggestions from REHAU and a proper design considering the whole hydraulic system is required to determine if the above material estimation will be sufficient to condition the space adequately.

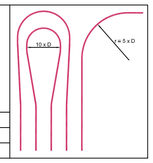
**This is an estimate only based on the information provided to us at the time of completing this proposal. The estimate assumes the building has sufficient thermal insulation to meet local building requirements, e.g. NZBC, BCA or BASIX, prior to the installation of the REHAU components. REHAU does not accept any liability for omissions of hydronic components, installation tools and accessories, or for any discrepancy in terms of quantity of materials (overestimate or underestimate) compared to the actual requirements. This material list terminates at the UFH manifold and may not include all components required to condition the space adequately. The amount and sizes for each article may change during the final design.*

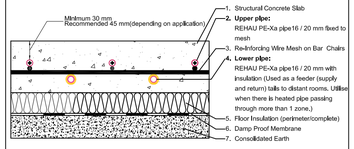
*Our verbal and written advice relating to technical applications and this quote is based on experience and is to the best of our knowledge correct but is given without obligation.*

## LAYING INSTRUCTIONS

Regardless of the graph indicated in this document, the minimum radius of curvature of the piping shall not be less than 5 x diameter.

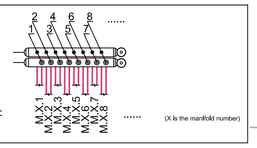
| | |
|---|---|
| Ø 16 mm | min. 80 mm |
| Ø 20 mm | min. 100 mm |
| Ø 25 mm | min. 125 mm |

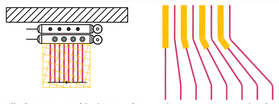



### Typical Floor Structure: In-Slab

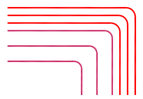
(general example only - not intended to satisfy the installation requirements for any particular project)



In installation areas with dense pipe work, we recommend to insulate part of the pipe work with corrugated conduit until the pipes reach the design pipe spacing.

Note: Depending on the structural load a minimum distance between the pipes needs to be considered, refer to a structural engineer for further advice.

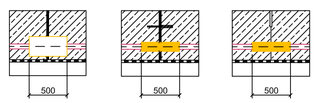


Pipe that is part of this zone

Passing pipe belonging to a circuit in another zone

Please also see the proposed floor structure

Only connecting lengths to and from floor loops are are allowed to cross construction joints. Pipes which do cross joints must be protected as shown below




Joints without anchors: Protected with insulation of same thickness as pipe outer diameter

Joints with anchors: Protected with REHAU corrugated sleeve

Saw cut joints: Protected with REHAU corrugated sleeve

1. PIPE LAYING INSTRUCTIONS

- Check that the passages indicated in the table are open, i.e. free from obstacles or other obstructions.
- Check that the thickness of the available floor conforms to the drawing.
- In the areas near the manifolds, where the circuits' delivery and return pipes are concentrated, it is recommended to insulate the pipes alternating, so as to prevent any excessive heat emission, and subsequently any uneven floor temperature.
- The expansion joints must be installed in the positions and according to the instructions specified. For screed / topping slab applications a single bay is not recommended to exceed either 40 m² or a maximum side length of 8m.

2. PRESSURE TESTING

Once the plant piping has been laid, it is necessary to proceed with the hydraulic testing as follows.

PRESSURE TEST WITH WATER
- Close ball valves at circuit and visually check all connections
- Fill and flush all heating circuits individually one after another and deaerate system
- Apply test pressure: minimum 4 bar (400kPa), maximum 6 bar (600 kPa)
- Reapply pressure after 2 hours , as the pressure may drop due to expansion of the pipe
- Test time 3 hours. The pressure test has been passed if water does not exit from any point of the pipeline and the test pressure has not dropped more than 0,1 bar (10kPa) per hour.

Warning:
A pressure drop may occur based on any temperature variations.
The pressure is likely to change by approx. 1 bar in case of differences of +/- 10°C.

PRESSURE TEST WITH AIR
- Contact REHAU for further advice on pressure testing with air.

On completion of the pressure test the pipe circuits can be covered with concrete/screed. Keep the system under operating pressure during pouring of the screed to detect any leaks straight away.

Warning:
Don't leave any water in the system when there is a risk of sub-zero conditions!

3. INITIAL WARM-UP

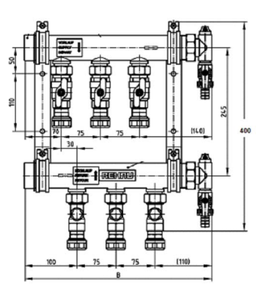
- In case of cement based screeds the initial warm-up must only be carried out after 21 days after laying (or as per manufacturer advice) to ensure the screed is correctly cured.
- In case of anhydride screeds the warm up can be carried out after 7 days
- The initial warm-up comprises the following two stages:
  Stage 1: operating the system for at least 3 days with a water temperature of 20°C to 25°C
  Stage 2: increasing the water temperature to the max design temperature and maintaining it for a minimum of 4 days
- It is recommended to document and record this test

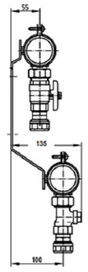
NOTE: The initial warm-up must NEVER be used to accelerate the drying / curing of the concrete / screed mix.

4. PLANT START-UP

- Let the air out of the plant, and carefully fill circuit by circuit.
  Install a drain pipe on the hose adapter and, after closing all circuits, fill a single circuit at a time, by opening the related lockshield valve.
- Repeat the same operation for all the other circuits.
- Set the regulation curve of the heating/cooling control station.
- Perform the hydraulic balancing of the circuits.
- Start-up and operate the plant.

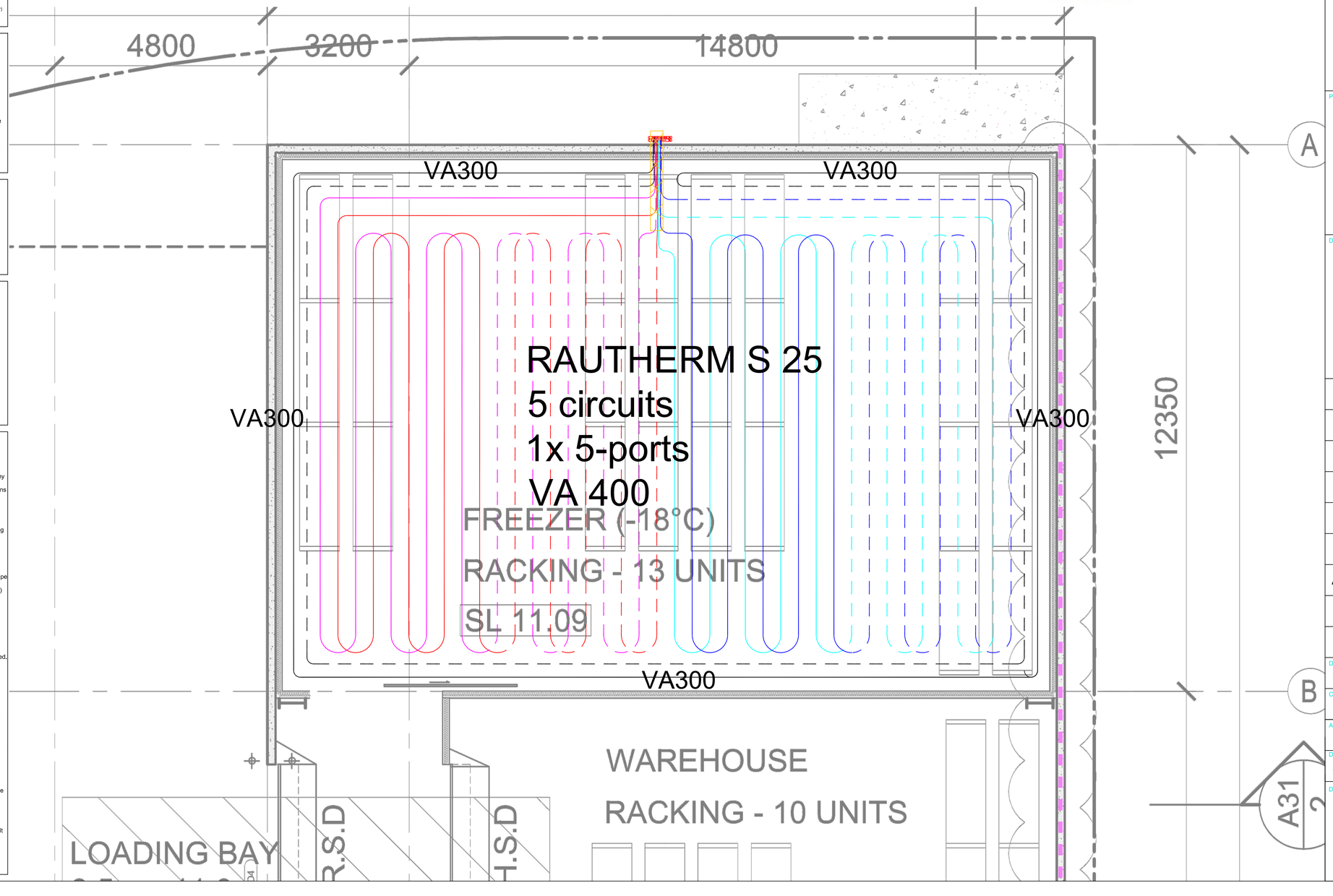
| Manifold No.: M.1 | | | | |
|---|---|---|---|---|
| Manifold type: | Circuits pipe: | | Total Flow Rate: | Pressure Loss: |
| Brass | RAUTHERM S 25x2.3 | | 23.1 L/min | 12.5 KPa |
| Circuit No.: | Pipe Spacing: ( mm ) | Total Length: ( m ) | Flow Rate: ( L/min ) | Turns Closed: |
| M.1.1 | 400 mm | 113 | 4.6 | 8 |
| M.1.2 | 400 mm | 113 | 4.6 | 8 |
| M.1.3 | 400 mm | 110 | 4.5 | 7 |
| M.1.4 | 400 mm | 112 | 4.6 | 7 |
| M.1.5 | 400 mm | 113 | 4.6 | 8 |




| Bezeichnung | Art. Nr. | Baulänge B mm | Gewicht kg |
|---|---|---|---|
| IVKE 2 | 248870-001 | 285 | 5,6 |
| IVKE 3 | 248880-001 | 360 | 7,2 |
| IVKE 4 | 248890-001 | 435 | 8,8 |
| IVKE 5 | 248900-001 | 510 | 10,4 |
| IVKE 6 | 248910-001 | 585 | 12,0 |
| IVKE 7 | 248920-001 | 660 | 13,6 |
| IVKE 8 | 248930-001 | 735 | 15,2 |
| IVKE 9 | 248940-001 | 810 | 16,8 |
| IVK E10 | 248950-001 | 885 | 18,4 |
| IVKE 11 | 248960-001 | 960 | 20,0 |
| IVKE 12 | 248970-001 | 1035 | 21,6 |

Baulänge gesamt (mit Verteilerendstück)

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NOTE

## IMPORTANT

This technical information is provided only for general quotation purposes and is based in part on information you provided. No representations, warranties, or guarantees are made regarding the suitability of REHAU technical information to meet code requirements for any particular project, nor regarding the accuracy of the costing of any project based upon this information.

This technical information is not intended to be used as final drawings or specifications and is provided only as an aid in architect's/engineer/installer's development of the final specification and is not intended as a substitute for sound architectural/engineering/installation judgment. The architect/engineer/installer shall be responsible to convert this technical information into a final specification that meets the functional and aesthetic needs of its client, as well as complying with all applicable codes and local climate conditions. Unless otherwise specified in this agreement, the standard REHAU Terms and Conditions of Sale shall apply and are available on request or at www.rehau.com.au. 

Legend

- Heating Pipe Flow (Solid)
- Heating Pipe Return (Dashed)
- Expansion Joint Profile
- Manifold

PROJECT TITLE

**WarmNZ-Stonedon Freezer**

DRAWING TITLE

**UFH CIRCUIT LAYOUT**

| No. | DESCRIPTION | DATE |
|---|---|---|
| A | First Issue | 25/02/20 |

ISSUES & REVISIONS

| | |
|---|---|
| DRAWN BY: D.P | SCALE: A1 1:50 A3 1:100 |
| CHECKED BY: D.P | |
| APPROVED BY: D.P | SHEET NO.: P1 |
| DATE: 25/02/20 | |

DRAWING No

**RDC-ANZ-19-113**