



BRANZ Appraised
Appraisal No. 398 [2013]

SUNFLOW® RADIANT FLOOR HEATING SYSTEM

Appraisal No. 398 [2013]

This Appraisal replaces BRANZ
Appraisal No. 398 [2008].

Amended 03 May 2013.



BRANZ Appraisals

Technical Assessments of
products for building and
construction.



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Product

- 1.1 The SunFlow® Radiant Floor Heating System is a low-temperature, hydronic embedded floor heating system. It is for installation in concrete floors of residential, commercial, and industrial buildings.
- 1.2 The floors are heated by hot water pumped through pipes cast in the concrete floor.

Scope

- 2.1 The SunFlow® Radiant Floor Heating System has been appraised for use as an embedded floor heating system within the following scope:
 - for use as cast-in pipe heating elements carrying hot water in slab-on-ground and suspended concrete floors.
 - *The scope of this Appraisal deals with the under-floor pipe-work system itself and does not appraise the control panel components or the source used for heating the water.*
 - *The installation of the SunFlow® Radiant Floor Heating System must be carried out only by personnel authorised by Heating Partners Ltd.*

Building Regulations

New Zealand Building Code (NZBC)

- 3.1 **In the opinion of BRANZ, the SunFlow® Radiant Floor Heating System, if designed, used, installed and maintained in accordance with the statements and conditions of this Appraisal, will meet the following provisions of the New Zealand Building Code:**
 - Clause B2 DURABILITY:** Performance B2.3.1 (a), not less than 50 years, B2.3.1 (b), 15 years and B2.3.1 (c), 5 years. The Sunflow® Radiant Floor Heating System meets these requirements. See Paragraphs 8.1 to 8.6.
 - Clause F2 HAZARDOUS BUILDING MATERIALS:** Performance F2.3.1. The SunFlow® Radiant Floor Heating System meets this requirement and will not present a health hazard to people.
 - Clause G9 ELECTRICITY:** Performance G9.3.1. The SunFlow® Radiant Floor Heating System meets this requirement. See Paragraphs 8.6, 10.1 and 12.2 to 12.3.
 - Clause G10 PIPED SERVICES:** G10.3.1 (a) The SunFlow® Radiant Floor Heating System meets this requirement. See Paragraph 11.1.
- 3.2 This Appraisal assesses an **Alternative solution** in terms of New Zealand Building Code Compliance.

Technical Specification

Description

- 4.1 The SunFlow® Radiant Floor Heating System consists of a range of PE-X and PE-X/Al/PE-X pipes and associated brass fittings.
 - Pipe sizes for PE-X pipes are 12/16 and 16/20 mm.
 - Pipe sizes for PE-X/Al/PE-X pipes are 12/16, 16/20, and 20/25 mm.
- 4.2 Pipes are supplied in coils of 50 m, 100 m, and 200 m. They are continuously marked along their length, every metre with information including the supplier name, its size and type, the standards that it complies with, the date of manufacture and the distance in metres from the end of the coil.

Handling and Storage

- 5.1 The SunFlow® Radiant Floor Heating components should be handled with care to prevent damage. On site, PE-X and PE-X/Al/PE-X pipes must be stored where they are not exposed to sunlight. Any prolonged exposure must be prevented by covering the pipes with UV opaque material.

Technical Literature

- 6.1 Refer to the Appraisals listing on the BRANZ website for details of the current technical Literature for The SunFlow® Radiant Floor Heating System. The Technical Literature must be read in conjunction with this Appraisal. All aspects of design, use, installation and maintenance covered in the Technical Literature and within the scope of this Appraisal must be followed.

Design Information

General

- 7.1 The SunFlow® Radiant Floor Heating System is a low temperature, hot water-based embedded floor heating system which is installed in buildings such as housing, communal residential and non-residential, commercial and industrial. The system is cast into new concrete slab-on-ground or suspended concrete floors.
- 7.2 The system uses conduction and long wave infra-red radiation to heat the space and occupants within a building. The hydrostatic pressure range is between 80 kPa and 200 kPa. The pipes for use in the floor have been rated for a maximum temperature of 60°C and a maximum pressure of 900 kPa.
- 7.3 Details on the advantages, limitations, design, installation and use of embedded floor heating systems are given in BRANZ Bulletin No. 491, and are relevant to the SunFlow® Radiant Floor Heating System.
- 7.4 Heat sources and components such as pumps, valves, and thermostats have not been assessed and are outside the scope of this Appraisal. All types of heat sources compatible with the SunFlow® Radiant Floor Heating System must comply with the NZBC and other relevant codes or standards.
- 7.5 The hot water heating system must be completely isolated from the potable water supply system.
- 7.6 The completed system is quiet in operation, with the only visible components being the wall thermostats and control panel.
- 7.7 Successful installation of the SunFlow® Radiant Floor Heating System will involve the co-operation of various trades-people to avoid damage during worksite operations.
- 7.8 Other plumbing and electrical services may be installed above or below the heating pipe-work during preparation prior to the concrete pour.

Heating Design

- 7.9 The heating system design, including the layout of the pipe, must be carried out by a suitably qualified designer.
- 7.10 In order to conserve energy, it is recommended that design and insulation of non-residential buildings be carried out in accordance with NZS 4243.
- 7.11 The heating system layout, and an approximate estimate of overall energy use, can be provided by Heating Partners Ltd prior to commencement of installation. Actual energy use will depend on the building, the standard of heating required and the level of thermal insulation in use.
- 7.12 Hot water circulating through the SunFlow® system can be heated by a choice of energy sources. Heat sources can be electric, gas or oil fired boilers, solid fuel boilers, wet-back systems, heat-pump systems or solar. Automatic operational control of the heat source is linked to the control panel. Individual room thermostats are also linked back to the panel.
- 7.13 Where a building is being renovated, or an existing heating system is being replaced, Heating Partners Ltd can provide specific designs for these applications. Such designs have not been assessed and are outside the scope of this Appraisal, but generally involve laying the system on an existing concrete floor and covering with a concrete topping or cement-sand screed.

Floor Design

- 7.14 Specific floor design must be in accordance with AS/NZS 1170 and NZS 3101: Part 1. Non-specific floor design must be in accordance with NZS 3604 or NZS 4229. Construction must be in accordance with NZS 3109.
- 7.15 Concrete cover over the top of pipe-work must be between 25 and 35 mm.

Damp Proof Membrane

- 7.16 A damp-proof membrane must be placed between the granular fill and the insulation under concrete slab-on-ground floors in compliance with NZS 3604, Paragraph 7.5.4.

Insulation

- 7.17 In housing, the building envelope must be designed to meet the requirements of NZBC Clause H1 Energy Efficiency. If the Schedule Method of NZBC H1/AS1 is used as a means of compliance, a heated slab floor must have a minimum R- value of R1.9 in all climate zones.

Floor Coverings

- 7.18 Floor coverings should be selected so that they offer the minimum resistance to the upward flow of heat. Floor coverings such as carpet or cork, will reduce the efficiency of heated floors. Refer to BRANZ Bulletin No. 491 for further details.

Durability

- 8.1 Under normal usage and maintenance conditions, the heating system pipes will provide a serviceable life of at least 50 years. This assumes the system is not filled with 'soft' water, non-potable water, or with water containing high levels of chlorine [i.e. in excess of that normally found in treated potable water].
- 8.2 After concreting, exposed sections of the heating system pipes must be protected from sunlight at all times as UV radiation may cause deterioration to the pipes.
- 8.3 Under normal usage and maintenance conditions, the dezincification resistant brass fittings supplied by the pipe manufacturer for use with the pipes will have a minimum serviceable life of at least 15 years.
- 8.4 Under normal usage and maintenance conditions, the control panel contents and any other readily accessible parts of The SunFlow® Radiant Floor Heating System will have a minimum serviceable life of at least five years.

Maintenance

- 8.5 The control panel and above-slab pipe-work are readily accessible for maintenance. This maintenance must be carried out by Heating Partners Ltd or its authorised agents.
- 8.6 Damaged or failed pipe-work embedded in the concrete will require a specialist authorised by Heating Partners Ltd to locate the fault and to carry out repairs.
- 8.7 Maintenance of electric wiring and components must be carried out by a registered electrician.

Spread of Fire

- 9.1 When the SunFlow® Radiant Floor Heating System is intended for use with fire resistance rated [FRR] suspended floor construction, an appropriate consultant should be engaged to ensure compliance with NZBC requirements. Heating Partners Ltd's advice should also be sought.

Electricity

- 10.1 Electrical installations must comply with NZBC Verification Method G9/VM1, Paragraph 1.0.

Water Supplies

- 11.1 The SunFlow® Radiant Floor Heating System is pressure tested as a closed circuit for any leakage during the construction process and again at the commissioning stage. The system is a closed circuit and is independent from the potable water supply.

Installation Information

General

- 12.1 Installation of the SunFlow® Radiant Floor Heating System must be in accordance with this Appraisal and the Technical Literature.
- 12.2 Installation of the electrical wiring and components must be by a registered electrician in accordance with the relevant provisions of NZBC Clause G9 and the requirements of the Electricity Regulations including the relevant New Zealand Electrical Codes of Practice.
- 12.3 The position of all plumbing and electrical work is determined before positioning the heating pipe-work.
- 12.4 Pipe-work is positioned in areas marked on the floor plans of the building. Connecting pipe-work is run through passageways and doorways.
- 12.5 All heating pipe loops start from and terminate at the point where the control panel will be mounted. The panel contains the means to operate and control the system including circulating pump, pressure relief valve, pressure and temperature gauges, respective regulators and thermostats and associated motorised valves. Air vents and expansion tanks required in the system are also installed.

Specific

- 12.6 The damp-proof membrane is placed over the granular base fill and the floor insulation is placed on top of the damp-proof membrane.
- 12.7 Once the insulation and steel reinforcing is completed, the PE-X or PE-X/Al/PE-X pipe is laid in a series of loops. All the continuous pipe-run loops originate and terminate at a manifold at the control panel. Pipe-work is kept in place by using cable ties to attach the pipe to the reinforcing steel mesh of the concrete slab. All pipe runs to be cast in concrete are laid as continuous loops without in-floor pipe connections. Where an in-floor pipe fitting connection is unavoidable, such as with local damage repair, the joint must be carefully wrapped with suitable tape to allow for any thermal expansion movement and to protect the joint from possible in-floor corrosion. In-floor connections of this type are outside the scope of the Appraisal.
- 12.8 Concrete is poured conventionally with the pipe-work set at a level of approximately 30 mm below the finished concrete surface. Pipe-work must not be laid under walls or closer than 300 mm to external walls, or 200 mm to internal walls, or in positions where heavy items such as machinery or storage racks will be permanently located.

- 12.9 Pipe-work is linked to the control panel, filled with water, sealed off, and completely isolated from the potable water supply before pressure testing of the complete system is carried out for a minimum of 24 hours in accordance with the Technical Literature.
- 12.10 When pressure testing has been successfully completed, the concrete is placed. Concrete should be placed within two to three days of installation of the pipe-work. The system is left pressurised, and monitored during the concrete pour/construction process. A drop in pressure at any time will indicate a leak that can be quickly isolated and repaired. Account should be taken however of possible pressure fluctuations due to expansion and contraction, due for example, to cold weather, or slab heating up in the sun on a hot day. Care must be taken to ensure the concrete is well-compacted around the pipe-work.
- 12.11 Wheelbarrows for concrete placement should be limited to runways which are clear of pipe-work.
- 12.12 A uPVC sleeve must be fitted where the pipe-work crosses control joints. Detail for the placement of these sleeves is given in the Technical Literature.
- 12.13 After concrete finishing, the position of pipe-work must be marked on an as-built floor plan and supplied to the site supervisor so that damage may be avoided during subsequent worksite operations, such as slab-cutting, and the placement of fasteners or services.
- 12.14 The concrete floor must be allowed to cure for at least four weeks before the system is commissioned by the installer.
- 12.15 Low levels of heating should be used initially to assist the concrete slab to dry out prior to laying floor coverings. Refer to BRANZ Bulletin No. 491.
- 12.16 The relative humidity of concrete substrates must be 75% or less before application of fixed floor coverings in accordance with NZBC E2/AS1, Paragraph 10.2 [d]. The concrete can be checked with a hydrometer as set out in BRANZ Bulletin 424. It should be noted that the recommendations of manufacturers of sheet vinyl or ceramic tile adhesives, or floor sealers and paints, may recommend lower concrete moisture levels for their products in which case these should take precedence.
- 12.17 Jointing of the pipe-work outside of the slab, or during any maintenance repairs of the embedded pipe-work, must only use the dezincification resistant brass fittings supplied by Heating Partners Ltd for use with their PE-X or PE-X/Al/PE-X pipes.

Basis of Appraisal

The following is a summary of the technical investigations carried out.

Tests

- 13.1 Assessment of electrical safety in compliance with AS/NZS 3100 has been carried out by Spectrum Laboratories, Auckland.

Other Investigations

- 14.1 An assessment was made of the durability of the embedded floor heating system by BRANZ technical experts.
- 14.2 The Technical Literature including installation instructions and operation manual, have been reviewed by BRANZ and found to be satisfactory.
- 14.3 Site visits were carried out to assess the practicability of installation.
- 14.4 The performance of similar hydronic floor heating systems used for over 30 years in Europe, over 40 years in the USA and over 27 years in New Zealand has been reviewed by BRANZ. The performance of embedded floor hot water plumbing systems in New Zealand and overseas (including durability and hazardous building materials issues), has been reviewed by BRANZ technical experts.

Quality

- 15.1 Manufacture of Heating Partners Ltd PE-X and PE-X/Al/PE-X pipes, has not been examined by BRANZ, but details of quality, composition and testing were obtained and found to be satisfactory.
- 15.2 Heating Partners Ltd PE-X and PE-X/Al/PE-X pipes and fittings are sourced from two manufacturers and have been granted one of the following, SAI Global WaterMark Certificate of Conformity evaluated to AS/NZS 2492 and AS/NZS 2537, SAI Global StandardsMark License manufactured to AS 4176 and DVGW type examination Certificates to W534 and W542.
- 15.3 Heating Partners Ltd is responsible for the quality of the products supplied.
- 15.4 Installation on site is the responsibility of installers authorised by Heating Partners Ltd.

Sources of Information

- BRANZ Bulletin No. 491 Embedded floor heating, October 2007.
- BRANZ Good Practice Guide – Concrete Floors and Basements, March 1998.
- AS 4176: 1994 Polyethylene/aluminium and cross-linked polyethylene/aluminium macro-composite pipe systems for pressure applications.
- AS/NZS 1170: 2002 Structural design actions.
- AS/NZS 3100: 2002 Approval and test specification – General requirements for electrical equipment.
- AS/NZS 3000: 2007 Australian/New Zealand Wiring Rules.
- NZS 3101 Part 1: 2006 Concrete Structures Standard.
- NZS 3109: 1997 Concrete construction.
- NZS 3604: 2011 Timber-framed buildings.
- NZS 4218: 2004 Energy efficiency – Small building envelope.
- NZS 4229: 1999 Concrete Masonry buildings not requiring specific engineering design.
- NZS 4243.1: 2007 Energy efficiency – Large buildings. Building thermal envelope.
- International Standard ISO 15875-2: Plastic piping systems for hot and cold water installations – cross-linked polyethylene (PE-X) – Part 2: Pipes.
- Ministry of Business, Innovation and Employment Record of Amendments for Compliance Documents and Handbooks.
- The Building Regulations 1992.

Amendments

Amendment No. 1, dated 3 May 2013.

This Appraisal has been amended to update Durability paragraph for UV exposure.





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16 April 2013

SUNFLOW® RADIANT FLOOR
HEATING SYSTEM



In the opinion of BRANZ, **SunFlow® Radiant Floor Heating System** is fit for purpose and will comply with the Building Code to the extent specified in this Appraisal provided it is used, designed, installed and maintained as set out in this Appraisal.

The Appraisal is issued only to **Heating Partners Ltd**, and is valid until further notice, subject to the Conditions of Appraisal.

Conditions of Appraisal

1. This Appraisal:
 - a) relates only to the product as described herein;
 - b) must be read, considered and used in full together with the Technical Literature;
 - c) does not address any Legislation, Regulations, Codes or Standards, not specifically named herein;
 - d) is copyright of BRANZ.
2. **Heating Partners Ltd:**
 - a) continues to have the product reviewed by BRANZ;
 - b) shall notify BRANZ of any changes in product specification or quality assurance measures prior to the product being marketed;
 - c) abides by the BRANZ Appraisals Services Terms and Conditions.
 - d) Warrants that the product and the manufacturing process for the product are maintained at or above the standards, levels and quality assessed and found satisfactory by BRANZ pursuant to BRANZ's Appraisal of the product.
3. BRANZ makes no representation or warranty as to:
 - a) the nature of individual examples of, batches of, or individual installations of the product, including methods and workmanship;
 - b) the presence or absence of any patent or similar rights subsisting in the product or any other product;
 - c) any guarantee or warranty offered by **Heating Partners Ltd**.
4. Any reference in this Appraisal to any other publication shall be read as a reference to the version of the publication specified in this Appraisal.
5. BRANZ provides no certification, guarantee, indemnity or warranty, to **Heating Partners Ltd** or any third party.

For BRANZ

Pieter Burghout

Chief Executive

Date of Issue:

16 April 2013