Rittling Linear Radiant
Ceiling Panels
A Trusted Name in Hydronic Heating

Since 1946, when Charles Rittling founded Rittling Heat Transfer, Inc., the company has led the industry in quality, responsiveness, and innovation. With patented and proven heating and cooling products, and custom-build engineering with CAD design capabilities, Rittling is a single source supplier for the full variety of hydronic solutions.

Based in Western New York, Rittling employs a highly skilled and diverse work force. Certified ISO 9001:2000, the company prides itself on the skills of its employees, the design talent of its engineers, and the cost saving innovations of management.

Rittling is a “green” company that helps protect our environment through conservation, recycling, and disposal — efforts that have been recognized in the award of 1997’s New York State Governor’s Award for Pollution Prevention.

Built for the Whole Construction Team
Whether you’re an architect, engineer, or contractor, Rittling hydronic heating products are built to keep your job moving smoothly. Exacting quality control and on-time delivery systems make it easier to coordinate the many different components and aspects of large-scale construction projects. Our on-staff engineering department and CAD systems result in lower operating costs, reduced pricing, and custom-build capabilities that rival any in the industry.

FEATURES AND RATINGS

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As Hydro-Air Components, Inc. has a continuous product improvement program, it reserves the right to change design and specifications without notice.
DESCRIPTION

Radiant heating is widely regarded as the most comfortable, healthiest, and most natural heating process available. People are warmed in the same way as they are warmed from the sun on a cool day. Floor drafts, cold spots, and dry air are eliminated. Low humidity levels, dust, air contaminants (mold, fungi, bacterium and viruses), all problems associated with forced-air heating, are greatly reduced and often completely eliminated. Other advantages include lower installed costs, lower energy usage, reduced maintenance, quiet operation, and more uniform heating of the space.

Our linear radiant ceiling panels were developed in response to the needs expressed by the architects, designers, and contractors that have been solving hydronic heating problems with Rittling products for many years. Radiant panel technology is a proven technology that has been in widespread use in Europe for over 100 years and with the increasing concerns over air quality in Canada and United States, is quickly growing in the North American marketplace.

Linear ceiling panels are made of extruded aluminum and are available in 6" width combinations and in lengths compatible with perimeter planning modules or the materials handling limitations of each particular project up to a maximum of 16 feet.

On the plenum side of each panel there is an innovative aluminum extrusion cap for the copper tubes that form circulating coils. The unique design of this cap and the efficiency of the mechanical bonding technique provide the panels with exceptionally high performance.

These highly efficient panels supply the heating requirements for a typical building while taking up as little as 12 to 24 inches of the perimeter ceiling plane. This innovative product affords not only the human comfort and efficiency long associated with radiant systems, but also unrestricted design freedom, outstanding aesthetics, space utility, flexibility, and economic feasibility.

The elimination of unsightly wall and floor-mounted units, by concealing the heating source in the ceiling, creates an unobstructed perimeter wall that allows unlimited creativity and flexibility in the interior design.

The Rittling linear radiant panels provide a narrow border around the ceiling perimeter that contrasts or compliments the most creative ceiling. They are effortlessly incorporated into a perimeter soffit drop or continuous window pocket.

The uniform, draftless heating provided by the system allows the total interior to be utilized, even at those locations where an occupant is seated adjacent to large areas of glass.

Re-allocation of space and occupant changes are easily accommodated when the open-office concept of floor-to-ceiling partitions are involved. Since the radiant panels can be furnished in lengths compatible with perimeter planning modules, layout changes can be easily implemented. Simply adjusting terminal connections and adding thermostatic controls accomplishes this.

Sound transmission is a non-issue since the Rittling radiant ceiling panels have a higher STC rating than most acoustical ceiling tiles.

It has long been recognized that radiant energy transfer is the most effective known method of transferring energy. Millions of square feet of radiant ceilings have been installed in various types of buildings, most notably office buildings, apartments, retail stores, hospitals, banks, churches, and airports. Today’s high fuel costs make the benefits of radiant systems economically advantageous for much broader applications, especially for office buildings.

The Rittling linear radiant ceiling panels epitomize both functional and economical efficiency in heating today's buildings.
Radiant energy is transmitted by electromagnetic waves that travel in straight lines, can be reflected, and heat solid objects but do not heat the air through which the energy is transmitted. All objects with a surface temperature above absolute zero transmit and absorb these waves in varying degrees depending on the body surface temperature. Every microscopic crevice of the surface absorbs and reradiates the heat to an adjacent, colder object. When examined under a microscope, a concrete surface shows a large number of crevices while polished steel or similar polished surface show no such crevices. Thus, a rough surface transmits radiant energy more efficiently than a polished surface. Unlike convection, which is actually a current of warmed air, radiant heat does not rise. The floor is kept as warm as all other absorbing objects in the room including the ceiling. The Rittling radiant ceiling panels, when placed around the perimeter of the space, create a uniform, draft-free thermal barrier.

The ability of a surface to emit or absorb radiant energy is known as emissivity. It is expressed as a ratio (decimal) of the radiating ability of a given material to that of a black body. A black body emits radiation at the maximum possible rate at any given temperature, and has an emissivity of 1.00. Figure 1. shows the emissivity of various products. For practical purposes, it can be assumed that a good emitter is a good absorber.

A surface with a high emissivity factor would radiate more energy than one with a lower value. For instance, copper, with an emissivity of 0.07 would have a low emissivity, but if painted with an enamel paint having an emissivity of 0.91, would have a much higher emissivity.

Radiant heat is transmitted by the sun and is the best and most well known example of radiant heat transmission. The effect of sun radiation is best experienced when the body is exposed to the sun’s rays on a cool but sunny day. Some of these rays striking the body come directly from the sun while other rays strike surrounding objects, where they are increased in wavelength and reradiated to the body as low temperature radiation, thus producing a comfortable feeling of warmth. If the sun suddenly disappears behind a cloud, there is an instant sensation of cold, although the air temperature does not vary at all during this brief time.

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>EMISSIVITY RATIO</th>
</tr>
</thead>
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<tr>
<td>Aluminum –</td>
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<tr>
<td>Commercial Sheet</td>
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<tr>
<td>Highly Oxidized</td>
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<tr>
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<td>Marble</td>
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<td>Paint –</td>
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<tr>
<td>White Lacquer</td>
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<td>White enamel</td>
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<tr>
<td>Wood – Oak, Planed</td>
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</table>
Perceptions of comfort, temperature, and thermal acceptability are related to activity, the transfer of body heat from the skin to the environment, and the resulting physiological adjustments and body temperature. Heat transfer is affected by the ambient air temperature, thermal radiation, air movement, humidity, and clothing worn. Comfort is associated with a neutral thermal sensation during which the human body regulates its internal temperature with minimal physiological effort for the activity concerned. It is sometimes thought that a radiant heat system is desirable only for certain buildings and only in some climates. However, anywhere people live, the three factors of heat loss (radiation, convection, and evaporation) must be considered. It is as important to provide the correct conditions in very cold climates as it is in warm climates. Maintaining the correct comfort conditions by heating with low temperature radiation is possible for even the most severe weather conditions.

Panel heating and cooling systems’ main function is to provide a comfortable environment, which is accomplished by controlling surface temperature and minimizing excessive air motion within the space. Thermal comfort, as defined by ASHRAE Standard 55-1981, is “that condition of mind which expresses satisfaction with the thermal environment.” An acceptable environment is defined as one in which at least 80% of the occupants perceive a thermal sensation between “slightly cool” and “slightly warm”.

When the surface temperature of the outside walls, particularly those with large amounts of glass, begins to deviate excessively from the ambient air temperature of the space, it is increasingly difficult for convective systems to counteract the discomfort resulting from cold or hot walls. Heating and cooling panels neutralize these deficiencies and minimize excessive radiation losses from the body. When the average unheated surface temperature falls below the mean panel temperature, the panels radiate energy into the room. This radiated energy does not immediately warm the air but actually warms the objects in the space including the walls, glass, floor, furniture, and people, which in turn, warm the air.

Radiant panel performance is directly related to the building in which it is located, differing from most heat transfer equipment where performance can be specifically measured, independent of its surroundings. Various outside sources have conducted research on panel performance where heat transfer between the radiant panel and the other room surfaces is well established. The primary heat gains and losses are from the wall, floor, and ceiling surfaces. This data should only be used in consultation with manufacturers experienced in this field.

Fortunately, most building surfaces have high emissivity factors and therefore actively absorb and reradiate energy from the panels. This is significant because all surfaces within the room tend to assume an equilibrium temperature resulting an even thermal comfort condition within the space. In much the same way that lighting is placed in the ceiling so that all objects can be “seen” without obstruction, the radiant panels are placed in the ceiling for the same maximum effect. An active radiant panel transmits energy that is absorbed and reradiated by all the room objects, thereby warming all surfaces. Warm ceiling panels are effective for winter heating because they warm the floor and glass surfaces by direct transfer of radiant energy. The surface temperature of properly constructed and insulated floors will be 3 - 4 °F (1 - 2 °C) above the ambient air temperature and actually provide a source of reradiated heat. In fact, where down drafts from cold walls or glazing present design challenges in respect to occupant comfort, radiant panels provide a solution. The ceiling panels warm the wall or window surfaces by direct transfer of radiant energy, significantly increasing the surface temperature of each. Testing has shown that inside single-glass surface temperatures of 10 - 15 °F (5 - 8 °C) above normally observed glass surface temperatures are realized, reducing air velocities to less than 50 fpm (0.25 m/s). As a result, downdrafts are minimized to the point where no discomfort is felt. Installation with ceiling heights of 50 ft (15 m) and single glass from floor to ceiling provide satisfactory results.
Selection Procedure

The design of an extruded radiant panel system should follow all the usual design considerations for a closed water system. There are a number of basic design criteria that need to be obtained in order to properly design the system. They include the following:

• Determine the room design temperature.
• Determine the heat loss for the room.
• Determine the design hot water entering and leaving temperatures.
• Determine the panel layout (i.e. continuous perimeter strip, between columns only, etc.)
• Determine the capacity of the radiant panels from the catalog using the mean water temperature.
• Calculate the area, width, and length of the panels.
• Calculate the water flow rate.
• Determine piping arrangement and water pressure drop per circuit.

The following standard formulas can be used to determine the necessary design criteria:

**Heat Loss:**

\[
\text{Total BTU/hr} = \frac{\text{BTU/hr Required Per Linear Ft.}}{\text{Lineal Ft. of Panel}}
\]

**Panel Width:**

\[
\text{Required BTU/hr Per Lineal Ft.} = \frac{\text{Panel Width in Ft.}}{\text{Panel Performance BTU/hr (From Catalog)}}
\]

**Flow Rate in GPM:**

\[
\text{GPM} = \frac{\text{Total BTU/hr}}{500 \times \text{Water Temperature Drop (°F)}} \times \text{constant}
\]

**DESIGN EXAMPLE #1**

For this example we will take an intermediate floor of a multi-floor office building.

- 80’ x 80’ building dimensions
- 12’ between floors
- Wall U = 0.15 BTU/hr · ft² · °F
- Glass U = 0.6 BTU/hr · ft² · °F
- 6’ continuous glass height
- Average U = 0.33 BTU/hr · ft² · °F

1. Calculated heat loss per floor:

\[
320 \text{ LF} \times 12' \times 0.33 \text{ BTU/hr · ft}^2 \cdot °F \times 70 \, °F = 88,704 \text{ BTU/hr Total Per Floor}
\]

2. Calculated heat loss per lineal ft. of perimeter wall:

\[
\frac{88,704 \text{ BTU/hr Total}}{320 \text{ LF of Wall}} = 277 \text{ BTU/hr Per Lineal Ft. of Wall}
\]
3. Determine length of extruded panels:

Standard panel lengths are available in 4 foot to 16 foot lengths in one foot increments. Select lengths most compatible with room dimensions and column spacing (i.e. 20' center-to-center column dimension will use (2) 10’ panels between columns).

4. Determine width of extruded panels:

The heating performance table (page 8) for the Rittling ceiling panel shows that a 200 °F MWT will produce 303 BTU/ hr · ft with a 12” panel which is more than the 277 BTU/ hr · ft of heat loss.

Therefore, a 12” wide (2-6” wide) panel will meet the performance requirements for this design.

5. Determine flow rate:

\[ \text{GPM} = \frac{88,704 \text{ BTU/hr}}{500 \times 20 \degree \text{F WTD}} = 8.87 \text{ GPM per floor, 2.22 GPM per zone} \]

6. Determine piping layout and WPD per circuit:

Below are two separate examples of panel circuit design.

**Example 1A – 20 °F WTD**

For this example, split an 80 LF exposure using (4) 10’ panels in each circuit. Each circuit will have 80’ of copper tubing + 7’ of equivalent copper tubing for interconnects with 1.11 GPM per circuit. Per the WPD table (page 9), each circuit will have a pressure loss of approximately 2.6’ of water.
Selection Procedure

Example 1B – 50 °F WTD
Entering Water Temperature = 195 °F
Water Temperature Drop (WTD) = 50 °F
Mean Water Temperature (MWT) = 170 °F
Heat Loss Per Floor = 88,704 BTU/hr

Panel performance = 195 °F EWT; 50 °F WTD; 170 °F MWT; 288 BTU/ hr · ft (18” wide panel)

1. Determine width of extruded panels:

   The performance table for the Rittling ceiling panel shows that a 170 °F MWT will produce
   303 BTU/ hr · ft with an 18” panel which is more than the 277 BTU/ hr · ft of heat loss.

   Therefore, an 18” wide (3-6” wide) panel will be the nearest width required to overcome the wall losses.

2. Determine flow rate:

   \[
   \text{Flow rate} = \frac{88,704 \text{ BTU/hr}}{500 \times 50 \text{ °F WTD}} = 3.55 \text{ GPM per floor, } 0.89 \text{ GPM per zone with a pressure loss of 5.1’ of water.}
   \]

DESIGN EXAMPLE #2

For this example we will take an intermediate floor of a multi-floor office building.

- 100’ x 200’ building dimensions
- 12’ between floors
- Heat loss per floor of 250,000 BTUH
- Outside design temperature of 0 °F
- Inside design temperature of 72 °F
- Supply water temperature of 210 °F
- Water temperature drop of (WTD) of 40 °F
- Mean water temperature (MWT) of 190 °F
- Bay length of 33’ 4”
- Column size of 2’ x 2’
- Owner requires 1 zone per 3 bays

For this example, the panels will be installed from column face to column face with 31’ 4” (33’4”-2’)
of panel required per bay because of the column size.
Selection Procedure

1. Calculated heat loss per lineal ft. of perimeter wall:

\[
\frac{250,000 \text{ BTU/hr Total}}{(18 \text{ bays}) (31'4'')} = 443 \text{ BTU/hr Per Lineal Ft. of Wall}
\]

2. Determine length of extruded panels:

Standard panel lengths are available in 4 foot to 16 foot lengths in 1 foot increments. Select lengths most compatible with room dimensions and column spacing. In this example, we will use (2) 16’ panels cut to length. The zone size will be 100’ of perimeter, however total panel length is 3 x 31’ 4” or 94’.

3. Determine width of extruded panels:

The performance table for the Rittling ceiling panel shows that a 190 °F MWT will produce 512 BTU/hr · ft with a 24” panel which is more than the 443 BTU/hr · ft of heat loss. Therefore, a 24” wide (4-6” wide) panel will meet the performance requirements for this design.

4. Determine flow rate:

\[
\text{GPM} = \frac{94' \times 443 \text{ BTUH/ft.}}{500 \times 40 \, ^\circ \text{F WTD}} = 2.1 \text{ GPM per zone}
\]

5. Determine piping layout and WPD per circuit:

Since the zone is composed of 2 circuits, each circuit will require 1.05 GPM each. Water pressure drop includes pressure drop through both panel and interconnects.

Equivalent length of copper tube:

- 94’ of panel x 2 passes (supply & return) = 188’
- Interconnects 3 x 2 passes x 1’ = 6’
- Total equivalent length = 188’ + 6’ = 194’

Equivalent length of copper tubing interconnects around columns = 2 interconnects x 2 passes x 10’ = 40’

Per the WPD table, the copper tube has a pressure drop of 2.69 ft./100 ft. at 1.05 GPM.

\[
\text{Pressure Drop} = \frac{194 + 40 \times 2.69}{100} = 6.3 \text{ ft. of water}
\]
### Heating Performance

**70 °F Air Temperature**  
Heating Performance Values in BTU/ft of Panel

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<thead>
<tr>
<th>MEAN WATER TEMPERATURE (°F)</th>
<th>PANEL WIDTH</th>
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<tbody>
<tr>
<td></td>
<td>6&quot;</td>
</tr>
<tr>
<td></td>
<td>1 Tube</td>
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<tr>
<td>120</td>
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<td>220</td>
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</tbody>
</table>
### Water Pressure Drop

**Design flow rates below 0.5 GPM are not recommended.**

For Rittling interconnects, add 12” to tubing length.

**1/2” Nominal Panel Tubing**

<table>
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<tr>
<th>GPM / Tube</th>
<th>ft. of H₂O per 100 ft.</th>
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<tbody>
<tr>
<td>0.05</td>
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<tr>
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<thead>
<tr>
<th>GPM / Tube</th>
<th>ft. of H₂O per 100 ft.</th>
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<tbody>
<tr>
<td>1.55</td>
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## Ceiling Opening Table

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<th>Nominal Panel Width</th>
<th>Finished Ceiling Opening</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot;</td>
<td>6 1/4&quot;</td>
</tr>
<tr>
<td>12&quot;</td>
<td>12 1/4&quot;</td>
</tr>
<tr>
<td>18&quot;</td>
<td>18 1/8&quot;</td>
</tr>
<tr>
<td>24&quot;</td>
<td>24 1/8&quot;</td>
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<tr>
<td>30&quot;</td>
<td>30&quot;</td>
</tr>
<tr>
<td>36&quot;</td>
<td>36&quot;</td>
</tr>
</tbody>
</table>
This detail compensates for an uneven outer wall.

Typical window pocket installation where panel is higher than ceiling.
   Wall angle molding on both sides.
Similarly, this detail may be used for a drop soffit where panel is lower than the balance of ceiling.
Typical connections for supply, return, and trimmed panels. Connect with type L $\frac{1}{2}''$ nominal soft copper tubing. Slip onto panel tubing (Nominal $\frac{1}{2}''$, $\frac{5}{8}''$ OD)

Flexible connections are used between panels when they are installed in series in the same room.
Linear radiant ceiling panels are a vital part of a building’s heating/cooling system and therefore must be properly maintained to provide many years of trouble-free heating/cooling. As long as the following procedures are followed, the system will remain problem-free.

**Installation**

All tubing used in the Rittling radiant ceiling panels is 1/2” nominal copper tube (0.625” OD). Standard size fittings work easily with the Rittling products. The panel tubing ends should be lifted up to approximately a 45 degree angle for attachment of U-bends or interconnecting flex connectors. The return bends, and if possible, the flexible interconnects should be installed at ground level. Be careful not to crimp tubing, as performance will be compromised. All copper tube connections require soldering or brazing to ensure a leak free system. Install copper connections first to tubing pass that is closest to perimeter wall. Circuiting of multiple panels should be done in a serpentine manner to ensure even flow over entire length of zone. Individual serpentine panel coils connected in series is unacceptable for multiple panel zones. All radiant panels shall run continuously from wall to wall. Field trim to length as required, allowing adequate room for expansion after installation. All radiant panels should be installed by workers wearing clean gloves to ensure a dirt-free surface.

An insulation blanket, usually 1” thick 1 lb. density, should cover the entire back of the panel. Cut the blanket to pass around the interconnecting piping and suspension wires. Make sure that each insulation blanket butts up tightly with the adjoining blanket. Do not place insulation blanket over lighting fixtures. Interconnecting piping does not require insulation and is not recommended by Rittling unless specifically required per specification.

**Operation**

The main heating lines should be flushed to remove any debris prior to connection to the radiant ceiling panels. After installation, the entire hydronic system should be flushed again and then pressure tested dry to check for leaks. After fixing any leaks, air should be vented from the system by reintroducing water at 0.5 GPM or higher. The water temperature should be brought up gradually to the design temperature. The design water temperature drop will only be attained when building is under full load. It is recommended that balancing of system should be done during the winter when full flow will be realized.

**Maintenance**

Maintenance is minimal for this type of heating system. Keeping strainers clean is the only real required maintenance concerning the piping system. Any descaling of the piping system should be performed as in any other hydronic heating system. The panels are designed to last and should be resistant to any damage. However, if there is noticeable damage to any of the panels, the piping should be inspected for leaks and the panels should be checked to make sure they are securely fastened.

**Cleaning**

The surface of the panels is easily cleaned with an industrial vacuum to remove dirt and dust. If the panels can not be adequately cleaned in this manner, use a damp cloth or sponge and mild detergent. Avoid abrasive cleaners on the painted surface. Frequent changing of the rinse water will help minimize streaking. All cleaning should be performed with thermostats in the off position and panels at room temperature. This will also help avoid streaking.
ARCHITECTURAL/ENGINEERING SPECIFICATIONS

1.0 General
1.1 Scope
.1 To provide an extruded linear ceiling panel system per plans and specifications.

1.2 Manufacturers
.1 Rittling
.2 Alternate manufacturers shall be equal or better than Rittling in regard to rows of tubes, capacity, water pressure drop, piping connections, and finish.

1.3 Quality
.1 Manufacturer shall be regularly involved in the production of linear radiant ceiling panel and have available published performance data.
.2 Submittal drawings shall include supply and return field connection locations along with interconnecting details.

2.0 Finished Product
2.1 .1 Constructed of 6” wide, 0.0725” thick extruded aluminum panels.
.2 Total width and number of tubes per design specifications.
.3 Tube saddles shall be an integral part of aluminum extrusion.
.4 Hot water tubing shall be 1/2” nominal Type L (5/8” OD) copper tubing, snapped into tube saddle and mechanically fastened to aluminum extrusion.
.5 Extruded aluminum panels shall interlock using tongue and groove connection and mechanically held together with steel cross braces.
.6 All interlocking of extruded aluminum panels, assembly of cross braces, and installation of copper tubes to be done at factory.
.7 Panels shall be supplied with white finish as standard (or as selected by engineer).

3.0 Equipment Schedule
3.1 Linear Radiant Ceiling Panel
.1 Manufacturer: Rittling
.2 Model: Linear
.3 Performance: BTUH/Lin. ft. or W/Lin. m
.4 Width: Specify
.5 Length: Specify
.6 Output based on ___˚F or ___˚C mean water temperature and 70˚F (21˚C) air temperature.
.7 The maximum water pressure drops shall be as follows:
   .5 gpm – 0.75 ft. of water per 100 ft. tube
   1.0 gpm – 2.45 ft. of water per 100 ft. tube
   1.5 gpm – 4.93 ft. of water per 100 ft. tube
   2.0 gpm – 8.11 ft. of water per 100 ft. tube
   2.5 gpm – 11.98 ft. of water per 100 ft. tube
   3.0 gpm – 16.48 ft. of water per 100 ft. tube

4.0 Installation
.1 The mechanical contractor shall cooperate with all other trades to ensure an aesthetically pleasing ceiling installation.
.2 All interconnecting of radiant panels by the mechanical contractor shall consist of 1/2” nominal (5/8” OD) flexible copper interconnects and return U-bends, supplied by Rittling.
.3 Hot water supply tubing to connect first to panel closest to perimeter wall. Multiple panels are to be connected to ensure serpentine flow across entire zone. Individual serpentine panels connected in series are unacceptable for multiple panel zones.
.4 All radiant panels shall be installed continuously from wall-to-wall. All radiant panels shall be trimmed in the field to allow enough room for expansion while maintaining adequate panel end coverage with architectural moldings.
.5 All radiant ceiling panels shall be installed by workers wearing clean, white gloves.
.6 All system piping shall be thoroughly cleaned, flushed, drained, and refilled before radiant ceiling panels are connected to system.
.7 Panels to be pressure tested per engineer’s specifications.
.8 All active panels shall be covered with a 1” minimum thickness of 1 lb. density insulation after connection and testing of panels is complete.
.9 Minimum of one wire hanger per cross brace. Minimum of two per panel.

WARRANTY

Zehnder Rittling guarantees its products to be free from defects in material and workmanship for a period of one year from date of shipment from our factory.

Should there be any defects in the good(s), the purchaser should promptly notify Zehnder Rittling. Upon receipt of written consent from Zehnder Rittling, the purchaser shall return the defective good(s) to the factory for inspection with freight prepaid. If inspection shows the goods to be defective, Zehnder Rittling will at its discretion repair or replace the said item(s).

Defects arising from damage due to shipment, improper installation, negligence or misuse by others are not covered by this warranty.

This warranty is extended only to the original purchaser from Zehnder Rittling.

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