INTRODUCTION
This booklet provides instructions to identify, handle, install and commission Dunham-Bush Evolution Style CG radiant panels. The instructions apply to panels from the standard range only. Please study the instructions carefully before commencing any installation work.

IDENTIFICATION
Refer to Diagram 1. On larger or more complex installations, Dunham-Bush may provide a baseboard layout (BL) drawing which will show details of each panel run, dimensions and panel part numbers. If specified on the order, each panel will be marked with a unique individual stencil reference, which may also be shown on the BL drawing.

DESCRIPTION
Evolution Style CG comprises aluminium alloy extruded planks with copper tube (carrying the hot water) mechanically located inside the extrusion. Insulation is fitted to the upper side of the panel to prevent heat loss upwards from the panel. Optional accessories for hanging and pipe jointing are supplied loose.

STANDARD RANGE OF PANELS AND SIZES
Each panel type is available as one tube (1T), two tube (2T), four tube (4T) and six tube (6T) variants and are available in nine different panel types:
- EA - standard panel
- EB - end panel
- EC - connection panel
- ED - single (stand-alone) panel
- EE - expansion panel
- EF - multi-circuit panel
- EG - dummy panel
- EH - flow connection panel
- EJ - return connection panel

Panels are available in the following nominal lengths: 600mm, 900mm, 1000mm, 1200mm, 1500mm, 1800mm, 2000mm, 2100mm, 2400mm, 2500mm, 2700mm and 3000mm

Typical panel designation:
Style CG-4T EC1200
- CG ceiling grid application
- 4T four tube
- EC connection panel
- 1200 nominal length 1200mm

<table>
<thead>
<tr>
<th>ITEM</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>CG EC4 PANEL ASSY</td>
</tr>
<tr>
<td>2</td>
<td>CG EB4 PANEL ASSY</td>
</tr>
<tr>
<td>3</td>
<td>PLANK CONNECTOR PLATE</td>
</tr>
<tr>
<td>4</td>
<td>4T PANEL JOINT ASSY</td>
</tr>
<tr>
<td>5</td>
<td>Ø15mm STRAIGHT COUPLING (YP)</td>
</tr>
<tr>
<td>6</td>
<td>No.8 SELF TAPPING SCREW PAN HEAD x 1/4</td>
</tr>
<tr>
<td>7</td>
<td>M6 STUD COCKING &amp; M6 NUT, WASHER (BY OTHERS)</td>
</tr>
<tr>
<td>A</td>
<td>50mm INSULATION NOT SHOWN</td>
</tr>
</tbody>
</table>

Diagram 1: Evolution Style CG-4T - typical panel run (1T, 2T and 6T panels similar)
Diagram 2: Typical panel arrangements (Style CG-4T and Style CG-6T panels shown)
Refer to BL (baseboard layout) drawing for project specific panel arrangement.
**CONSTRUCTION**

**Delivery**
The purchaser is responsible for off-loading, and must examine the radiant panels promptly upon receipt. Any claims for damage or incomplete shipment will only be accepted if, at the time of delivery, the consignment note is endorsed with the details and counter signed by the transport driver.

**Handling**
Radiant panels are usually palletised so a fork-lift or similar will be required for lifting. Individual panels can usually be handled by one or two persons. Panels must not be dropped or suffer impact in any circumstances.
Panels can be hoisted into position using a telescopic gas-operated hoist or similar equipment, following the equipment manufacturer's recommendations.

**Storage**
Radiant panels should be stored in clean, dry indoor conditions. Packaging should not be removed until the panel is required for installation (the radiant surface of each panel is covered in a protective film which should be removed when installation and commissioning is complete). Any packaging should only be removed if damage is suspected at the time of delivery.

**Preparation**
Evolution Style CG radiant panels are intended for horizontal installation within a standard 600mm 'lay-in' tile ceiling grid; *hence it is important to liaise with other trades to co-ordinate installation*. Provision must be made for proper fixings; the ceiling, soffit or structure must be suitable to accept proposed fixings such as expanding anchors, drop rods, lindaptors etc. Refer to Table 1 for panel masses.

Access is recommended for maintenance i.e. pipe connections. Ceiling tiles, builders work etc should be removable with sufficient clearance. Evolution should be free to expand during normal operation.

**Warning**
Some components may have sharp edges. Care must be taken when handling the product and protective gloves should be worn.

<table>
<thead>
<tr>
<th>Nominal panel length (mm)</th>
<th>600</th>
<th>900</th>
<th>1000</th>
<th>1200</th>
<th>1500</th>
<th>1800</th>
<th>2000</th>
<th>2100</th>
<th>2400</th>
<th>2500</th>
<th>2700</th>
<th>3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mass of panel 1T (kg)</td>
<td>1.5</td>
<td>2.3</td>
<td>2.6</td>
<td>3.1</td>
<td>3.8</td>
<td>4.6</td>
<td>5.1</td>
<td>5.4</td>
<td>6.1</td>
<td>6.4</td>
<td>6.9</td>
<td>7.7</td>
</tr>
<tr>
<td>Mass of panel 2T (kg)</td>
<td>3.1</td>
<td>4.6</td>
<td>5.1</td>
<td>6.1</td>
<td>7.7</td>
<td>9.2</td>
<td>10.2</td>
<td>10.8</td>
<td>12.3</td>
<td>12.8</td>
<td>13.8</td>
<td>15.4</td>
</tr>
<tr>
<td>Mass of panel 4T (kg)</td>
<td>6.1</td>
<td>9.2</td>
<td>10.2</td>
<td>12.3</td>
<td>15.4</td>
<td>18.4</td>
<td>20.5</td>
<td>21.5</td>
<td>24.6</td>
<td>25.6</td>
<td>27.6</td>
<td>30.7</td>
</tr>
<tr>
<td>Mass of panel 6T (kg)</td>
<td>9.2</td>
<td>13.8</td>
<td>15.4</td>
<td>18.4</td>
<td>23.0</td>
<td>27.6</td>
<td>30.7</td>
<td>32.3</td>
<td>36.9</td>
<td>38.4</td>
<td>41.5</td>
<td>46.1</td>
</tr>
</tbody>
</table>

Table 1: Masses of Evolution Style CG radiant panels
Diagram 3: Typical section detail for installation Style CG-1T (insulation not shown)

Diagram 4: Typical section detail for installation Style CG-2T (insulation not shown)
Diagram 5: Typical section detail for installation Style CG-4T (insulation not shown)

Diagram 6: Typical section detail for installation Style CG-6T (insulation not shown)
Diagram 7: Suspension point locations for Evolution Style CG.

<table>
<thead>
<tr>
<th>Nominal Length</th>
<th>Dim. A</th>
<th>X-No. 1 Tube</th>
<th>X-No. 2, 4 &amp; 6 Tube</th>
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<tbody>
<tr>
<td>600</td>
<td>-</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>900</td>
<td>-</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
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<td>1200</td>
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<td>2</td>
<td>4</td>
</tr>
<tr>
<td>1500</td>
<td>-</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>1800</td>
<td>900</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>2000</td>
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</tr>
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<td>6</td>
</tr>
<tr>
<td>3000</td>
<td>1500</td>
<td>3</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nom. Width</th>
<th>Dim. B</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>-</td>
</tr>
<tr>
<td>300</td>
<td>148.5</td>
</tr>
<tr>
<td>600</td>
<td>445.5</td>
</tr>
<tr>
<td>900</td>
<td>742.5</td>
</tr>
</tbody>
</table>

NOTES:
1. PANEL TO BE SUSPENDED VIA M6 STUDDING AND SHAKE PROOF NUTS (BY OTHERS)
2. PANEL TO BE LEVELLED TO CEILING GRID DATUM PRIOR TO MAKING JOINTS.
3. 4 TUBE SHOWN - APPLIES TO 1, 2 & 6 TUBE PANELS.

SYMBOL * DENOTES RECOMMENDED POSITION OF SUSPENSION BRACKETS TO SUPPORT PANEL LOAD EVENLY.
INSTALLATION

General
Refer to the layout (BL) drawing supplied with the panels for panel arrangement. Panels can be installed before or after a ceiling is installed. When two or more panels are to be installed in a run, then pipework is interconnected using 15mm straight couplings or expansion hoses provided.

Fitting
1. Prepare suitable fixings to accept the radiant panels. Refer to Diagrams 3, 4, 5, 6 and 7 for fixing positions.
2. Suspend the panel and level it with the suspended ceiling grid. Note that panels are best suspended by drop rods to the suspension brackets.
3. If two or more panels are to be installed in a run then clean and flux the pipe ends on both panels. Fit the slip couplings and joint strip to the first panel.
4. Suspend the second panel, level it to the first panel and engage the pipes of both panels into the couplings.
5. Check that all panels are located correctly, level and in a straight line. Fit the connector plates to align the panels, using the self-tapping screws provided.
6. Centralise the slip couplings on the pipe joint, apply heat to make each joint to an accepted method (see Diagram 8).
7. Ensure that panels are interconnected correctly. EC, EH and EJ panels are positioned at the connection end (flow and return) of panel run, whereas EB panels are positioned at the opposite end. EA and EE panels are used at intermediate positions – see Diagram 2. ED panels are single (stand-alone) panels.
8. Refer to Pipework Connections for connecting the panels to the mains.
9. Fit the insulation foil face upwards, fixed with the self-adhesive foil tape supplied. Leave the protective film on the radiating surface until installation and commissioning is complete.

Expansion Joints
1. Expansion (EE) panels should be fitted:
   i) every 6m of straight panel run for:
      - Style CG-1T (150mm nominal width)
      - Style CG-2T (300mm nominal width)
      - Style CG-4T (600mm nominal width)
   ii) every panel joint of straight run for:
      - Style CG-6T (900mm nominal width).
2. Expansion hoses should be fitted in place of the slip couplings. Note that the hoses will require pre-bending prior to fitting. (see Diagram 9).
3. The expansion hoses allow for differential expansion between the copper pipe and the aluminium extrusion in the panel.
4. Sufficient clearance should be allowed for overall expansion of the radiant panels, which will depend on the length of the panel run; contact Dunham-Bush for guidance.

Pipework connections
1. Connection to the mains is made via EC, ED, EH and EJ panels.
   - EC and ED panels are plain 15mm plain copper tube.
   - EH and EJ panels are plain 15 or 22mm copper tube, specified at order stage.
   - Flow and return connections are formed upwards for connection from above and are interchangeable.
2. Flexible hoses are recommended to allow for rapid installation and flexibility.
3. Local isolating and regulating valves are recommended, as well as drains, vents and strainers.
Diagram 8: Installation detail of Evolution Style CG - standard joint

Diagram 9: Installation detail of Evolution Style CG - expansion joint
COMMISSIONING

1. Check the fastness of all fixings and pipe joints. Ensure that the insulation is fitted correctly and that the radiating surface is not damaged.
2. Purge the air from the system using air vents in the main (by others).
3. Hydraulically pressure test the panels and check for leaks. Refer to Table 2 for test and working pressures.
4. Balance the water flow rate through the panel to accepted practice to achieve the specified flow rate.
5. Leave this document and any layout drawings with the end-user.

<table>
<thead>
<tr>
<th>Maximum cold test pressure</th>
<th>10.5 bar gauge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum working pressure at 90°C</td>
<td>7.0 bar gauge</td>
</tr>
</tbody>
</table>

Table 2: Recommended test and working pressures

Diagram 10: Evolution Style CG-4T - showing pipework connections between panels (insulation removed)
GENERAL GUIDANCE

1. **Preparation**
   Planning and preparation of ceiling openings is important; openings should be uniform, straight and free from all obstructions prior to panel installation. It is essential to co-ordinate all installation works with other trades.

2. **Layout**
   Panel runs should be set out on a layout plan. Radiant panels should be concentrated in areas of highest heat loss i.e. around the outside perimeter of the room, particularly near windows. This will counteract disproportionately high heat losses. Single or dual circuit runs should be considered - see Water flow rates and Hydraulic Resistances below.

3. **Maximum mounting height**
   There is no maximum mounting height for Evolution. However, when mounting heights exceed 4m, the heat load should be adjusted to allow additional losses of radiant heat incident on walls and stratification of air which absorbs some heat by convection.

4. **Minimum mounting height**
   There is no minimum mounting height for Evolution. For comfort and safety, the rule-of-thumb minimum mounting height is 2.4m. Contact Dunham-Bush for further information on mounting heights and comfort conditions.

5. **Panel runs**
   Refer to Diagram 2 for typical arrangements in a panel run. Dunham-Bush will prepare complete baseboard layout drawings for approval, which can be used to co-ordinate materials and installation on site.

6. **Water flow rates**
   To ensure rated heat outputs are achieved, water velocity in the tube should be such the water flow is turbulent. This maximises heat transfer from the water, through the tube and to the radiating surface. Water flow rates should also be limited to inhibit noise and erosion and high pressure drops. Water velocities should ideally be between 0.3 - 1.0m/s.

7. **Hydraulic resistances**
   Evolution utilises 15mm OD copper tube to transport hot water. To calculate the total pressure drop, determine the water flow rate:

   \[
   \text{Water flow rate (kg/s)} = \frac{Q}{C_p \times \Delta T}
   \]

   \(Q\) = total heat output from panel run (kW)

   \(C_p\) = specific heat capacity of water (kJ/kgK); approx. 4.187 for most applications

   \(\Delta T\) = water temperature drop

   Obtain the hydraulic resistance from the graph below. Note that the water flow rate should be halved if dual circuit panel runs are used (i.e. type EH and EJ panels). N.B. circuit length applies for one circuit only.

   ![Diagram 11: Hydraulic resistance (per panel circuit)](image)

8. **Ceiling Grid Applications**
   Evolution Style CG is designed to fit into conventional 'lay-in' tile ceiling grids; panel dimensions have been optimised so that panel edges are concealed by standard ceiling grid T-bars - typically 15mm or 24mm.

9. **Plaster Board Ceiling Applications**
   Evolution Style CG can be installed flush into a plasterboard ceiling, with typical edge trims by others; builders work should include access for commissioning and maintenance. (See Diagram 12). There should be a clearance of approximately 3mm at each end to allow for thermal expansion.

10. **Other Applications**
    For other types of ceiling, Style FS or Style CS panels may be more appropriate. Style WS panels are designed for vertical wall surface applications. Contact Dunham-Bush for details.
Diagram 12: Style CG installed flush into a plasterboard ceiling (typical ceiling interface trim by others).
MAINTENANCE

Dunham-Bush Evolution radiant panels are essentially maintenance free, with no moving parts. Panel surfaces can be washed with mild cleaner or detergent followed by rinsing. Strong, abrasive or mechanical cleaning should not be used. If panels or accessories become damaged, they can be replaced after isolating, draining and disconnecting from pipework or adjacent panels.

SPARES/SERVICE

PLEASE WRITE THE DETAILS OF RADIANT PANELS HERE.
These details will be required when ordering spares for your Dunham-Bush radiant panels

STYLE AND No. OF TUBES

BL DRAWING OR ORDER No.

DATE OF INSTALLATION

Spare parts/service - Please contact our office, contact information shown below.

Manufacturer reserves the right to change any product specification without notice.

Dunham-Bush Ltd, Downley Road, Havant, Hants, PO9 2JD

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