GENERAL NOTES
The Crane D991 PICV;
• can be used in variable volume heating and chilled water systems
• provides modulating control for terminal units when installed with a modulating actuator
• offers flow rate pre-setting
• has an equal percentage control characteristic at all pre-set flow rates
• has built in Differential Pressure Control
• has an operating temperature: -10 to 100°C
• has a maximum working DP = 3.5 bar
• has a maximum operating pressure: 16 bar
• has built in pressure test points to verify operational differential pressures

These instructions apply to the D991 when installed as a ‘standalone’ valve or when supplied as part of the Crane Fluid Systems Dominator range.

LIMITS OF USE
These valves have been categorised in accordance with the Pressure Equipment Directive • PED.
The fluid to be transported is limited to Group 2 liquids i.e. non-hazardous.
On no account must these valves be used on any Group 1 liquids, Group 1 gases or Group 2 gases.
INSTALLATION

These instructions are issued as guidelines only and do not cover all installed conditions. If unsure please contact our Technical Helpline before installation.

- Crane Fluid Systems products are designed for installation and use within suitably designed systems reflecting CIBSE, BSRIA and HVAC guidelines. Particular care should be taken with regards to;
  - accessibility to valve for setting/adjustment
  - tube cutting
  - jointing
  - bracketing/supports
- orientation: whilst the PICV can operate correctly in different orientations, there are recommendations regarding the orientation of actuators - see diagram on page 5
- would normally be installed on return pipework, i.e. after the equipment it is controlling, but can be installed in flow if required
- ensure direction of flow is correct - indicated by cast arrow on body
- D991 operates between a minimum and maximum pressure drop across the valve - see commissioning
- PICV’s are not designed as isolation valves. Dedicated isolation valves should be installed to isolate against system pressure, i.e. for maintenance etc., when disconnecting/draining pipework
- systems should be installed with strainers to protect the PICV and other installed items

FLUSHING

Control valves, like the PICV, are sized to give good control over the system water, therefore, have been designed with small convoluted flow path. These water ways may not allow adequate water velocities for flushing of the coil, even when fully open. Therefore, in line with BSRIA recommendations, it is recommended that a flushing point be located between the coil and the PICV. This allows the coil to be flushed without the water passing through the PICV.
SET POSITION

The PICV set position can be established by:

1. Calculation
2. Use of look up table on page 4

1. ESTABLISH SET POSITION BY CALCULATION

- Identify installed valve from ID Plate on bottom of valve
- From the chart below, establish maximum flow rate (P10 Flow)
- Divide required flow rate by fully open flow rate x 100 to establish % open setting:
  
  \[
  \text{e.g. flow rate at 100\%} = 0.28 \text{ l/s} \\
  \text{required flow rate} = 0.168 \text{ l/s} \\
  \left(\frac{0.168}{0.28}\right) \times 100 = 60\%
  \]

2. Use of look up table on page 4

- Identify installed valve from ID Plate on bottom of valve
- Check flow rate required
- Read across chart:
  
<table>
<thead>
<tr>
<th>Valve = DN20</th>
<th>Required flow rate = 0.168 l/sec</th>
<th>Set position = 6</th>
</tr>
</thead>
</table>

To set the valve, use the setting key provided to close the valve (position 0), then re-open the valve by turning the setting key anti-clockwise until position 6 is reached. Remove the setting key. The valve is now ready for actuator to be fitted.

COMMISSIONING

The D991 controls the flow rate depending on its set position, therefore, removing the need to measure the flow rate.

The D991 maintains a constant differential pressure across its internal seat, any excess pressure being removed by the internal differential pressure controller. To ensure that sufficient pressure is available for the differential pressure controller to control the flow rate correctly, a differential pressure reading should be taken using the test points provided.

When taking differential pressure readings, it is important that the system is running at full load, i.e. with all PICVs open. This ensures that differential pressure readings are carried out in the most unfavourable conditions, guaranteeing optimum performance in normal running conditions.

To ensure that all PICVs are working at the required differential pressure, it is necessary to check the least favoured / index PICV. By verifying the least favoured PICV is set to the required differential pressure, all other PICVs must have a higher differential pressure. However, we would also recommend that a selection of other PICVs are tested along the circuit to verify this.
DIFFERENTIAL PRESSURE REQUIREMENTS

Each valve size (DN15-DN32) at each % setting option requires a specific constant ΔP (Differential Pressure) to ensure the PICV is within its working range;

<table>
<thead>
<tr>
<th>DN15 LF</th>
<th>DN15 STD FLOW</th>
<th>DN20</th>
<th>DN25</th>
<th>DN32</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Typical Δp</td>
<td>FLOW</td>
<td>POS</td>
<td>Typical Δp</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>0.008</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>3</td>
<td>14</td>
<td>0.017</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
<td>0.026</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>5</td>
<td>14</td>
<td>0.035</td>
<td>5</td>
<td>12</td>
</tr>
<tr>
<td>6</td>
<td>14</td>
<td>0.044</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>7</td>
<td>14</td>
<td>0.053</td>
<td>7</td>
<td>12</td>
</tr>
<tr>
<td>8</td>
<td>14</td>
<td>0.062</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>9</td>
<td>14</td>
<td>0.071</td>
<td>9</td>
<td>12</td>
</tr>
<tr>
<td>10</td>
<td>14</td>
<td>0.080</td>
<td>10</td>
<td>12</td>
</tr>
</tbody>
</table>

For flow rates in between settings, extrapolation of position can be used.

The pump speed should be set to ensure that the required differential pressure is always available. By setting the differential pressure across the least favoured PICV to the value stated in the above table, it ensures that minimum pump energy is used, therefore, reducing system running costs and CO₂ emissions.

To set pump speed to achieve this; whilst measuring ΔP, increase pump speed until a constant ΔP is achieved, however please note that the typical ΔP value, as shown in the table above, can differ but in itself is not important.

The optimum setting is achieved when there is sufficient, but not excessive, pump pressure available.

Flow rate verification should be carried out using separate Flow Measurement Devices (FMD) where fitted. In line with CIBSE & BSRIA recommendations, we recommend that as a minimum requirement, FMDs are installed in all branches.

Where flow rate verification is required at terminals, FMDs may also have been installed at each terminal. Terminal flow rates can also be confirmed by measuring branch flow rates and closing individual terminal PICVs one at a time and measuring the reduction in flow at the branch. Care should be taken to ensure that reduced flow rates are still within the measuring range of the branch FMD, i.e. that the measured ‘signal’ doesn’t drop below 1kPa.
**ACTUATOR OPTIONS**

The D991 PICV is designed to work with ACT991M modulating actuators, ACT991TP three-point actuators and ACT991TH thermal actuators. (ACT991TH for sizes DN15-DN25 only).

For Installation, operating and maintenance guidance on the ACT991TP (Three Point) please see separate IOM shipped with the actuator.

Crane cannot be held responsible for the control function if alternative actuators are used.

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**ACT991M (MODULATING) ACTUATOR:**

To fit the actuator, remove protective cap from the valve, and follow the installation instructions supplied with the actuator. The connecting thread on the valve and actuator is M30 x 1.5.

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![Overall Dimensions](image1)

![Mounting Options](image2)

![Temperature Limits](image3)

The LED at the front of the actuator signals actuator position:

- **Off**
- **Green Blinking** = Moving to position
- **Solid Green** = Position reached
- **Red Blinking** = Power on – calibration
- **Solid Red** = Power failure – no signal

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![Actuator operation indicator](image4)

![Wiring Diagram](image5)
CONNECTING TO VALVE

Before fitting to valve:
Ensure that spindle is fully retracted (1)
Carefully align actuator and valve connection threads (2)
Turn actuator connection nut clockwise to secure to valve (3)
Hand tighten only (4)
Do not over-tighten.

ACTUATOR SETTING UP

Customer only needs to remove lid if changing settings from default below.

1 Ensure that power supply is disconnected
2 Gently loosen actuator cover from main body
3 Remove cover, and keep in safe place

ELECTRO-MECHANICAL ACTUATOR: ACT991M

24VAC/DC, 50/60Hz, 2.5VA
140N Min. - 8s/mm - IP43
0-10V Input Signal

*Default setting
THERMAL ACTUATOR: ACT991TH (NORMALLY CLOSED)

Thermal actuators are designed for ON/OFF control. Thermal actuators are small, light, and therefore a good choice for confined spaces. Thermal actuators are rated to IP54 and can be installed in any orientation.

To fit the actuator, remove protective cap from the valve, and follow the installation instructions supplied with the actuator. The connecting thread on the valve and actuator is M30 x 1.5.

FITTING THE ACTUATOR:

The valve and actuator have matching threads. The actuator comes supplied with an adaptor ring, so no additional one is required. Simply screw the adaptor ring onto the valve and fit the thermal head onto it. Rotate the lower ring until you hear two clicks.

The rotation of the lower ring of the actuator onto the valve sets the valve to its normally closed position.
WIRING INSTRUCTIONS

When servicing make sure that:

• the electric supply to the actuator is switched off to avoid possible damage to the equipment, personal injury or shock
• make sure that the line power supply is in accordance with the power supply specified on the actuator
• all wiring should conform to local codes and must be carried out by authorized personally only
• do not touch or attempt to connect or disconnect wired when electric power is on
• do not open or attempt to repair, contact the Technical department.

Supply voltage for the Crane ACT991TH actuator is 24V AC/DC and the actuator is Normally Closed.