**System Overview**

The Kinetics UPW 100 Water Purification System is a standard purity turnkey ultrapure water system, targeted for photovoltaic thin film applications. With a make-up stage capacity of 5, 10, or 17 M³/hour, the UPW 100 system can be configured for several capacity ranges at the polishing stage. The system produces consistently clean water, up to a resistivity of 10 MΩ·cm. Using a combination of reverse osmosis, electro-deionization, and mixed bed polishing units, the system carefully controls the levels of dissolved solids, total organic carbon, particles and critical metals to less than 10 ppb. A combination of standard and optional instrumentation provides the data to ensure a consistent level of water purity, on a continuous basis.

**Key Features:**

- Fully-automated operation
- Independent local PLC controllers on RO, EDI and UV units
- Water Softening Unit prior to RO module
- Single RO supply pump
- Reverse Osmosis Unit, for molecular impurity removal
- Electro-deionization unit, for removal of ionic contaminants
- UPW storage tank, with DI return line
- UV disinfection, to remove bacterial contaminants
- Mixed-bed ion exchange polisher
- Final Filtration at 0.2 µm
- Instrumentation for temperatures, pressures, unit flow rates, conductivity, and tank levels

**Options:**

- Buffer tanks for softened water and RO permeate
- Anti-scalant dosing module, for protection of RO membrane
- Redundant modules for pumps, electro-deionization and final filtration units
- Heat exchangers on pre-treatment and polishing stages, to improve system economy
- On-line instruments for measurement of TOC, particles, and silica
- Neutralization and reclamation of DI water from process operations
- Centralized PLC controller and graphical user interface
**Unit Operations**

- **RO Pre-treatment:** Chemicals added to reduce calcium, magnesium, chlorine and scale-formation that impede the RO membrane
- **Reverse Osmosis:** A semi-permeable membrane removes salts and dissolved impurities
- **Electro-Deionization:** Removes ionic species using electrically-active media and electrical current
- **UV Disinfection:** Ultraviolet light removes viable organisms
- **Mixed Bed Polishing:** Removal of dissolved ions, using a cation/anion mixed resin bed
- **Final Filtration:** Membrane to remove particles ≥ 0.2 μm

**Controls**

- Standard configuration utilizes local, independent PLC controllers on the RO, EDI and UV Disinfection modules
- Options for centralized PLC and HMI Graphical Interface, displaying the following parameters:
  - Process Flow Diagrams
  - System P&ID status
  - Adjustment of Reverse Osmosis parameters
  - Values of flow rate and filtration pressure
  - Alarm & Maintenance Screens

**Facility Requirements**

<table>
<thead>
<tr>
<th>Utility</th>
<th>Requirement</th>
<th>Connection Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Power</td>
<td>380 Volt, 50 Hz, 3 ph, 6-20 Amps</td>
<td>¾” conduit</td>
</tr>
<tr>
<td>CDA</td>
<td>4 – 45 SCFM, 90 psi (6 – 70 Nm³/hr @ 6 barg)</td>
<td>SS Swagelok or similar</td>
</tr>
<tr>
<td>Chilled Water</td>
<td>44 GPM, max @ 72 psi (10 M³/hr @ 5 barg), 6 – 15 °C</td>
<td>Flange or Threaded, 1” – 4”</td>
</tr>
<tr>
<td>Influent Water</td>
<td>35 – 125 GPM @ 70 – 100 psi (8 – 28 M³/hr @ 5 – 7 barg), 5 – 20 °C</td>
<td>Flange or Threaded, 2” – 5”</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>12 SCFM, max @ 85 psi (18 Nm³/hr @ 6 barg)</td>
<td>SS Swagelok or similar</td>
</tr>
<tr>
<td>Sanitary Drain</td>
<td>48 GPM, max (10 M³/hr, max), Gravity</td>
<td>Flange or Threaded, 1” – 2½”</td>
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**Specifications**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Capability</th>
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<tbody>
<tr>
<td>Application</td>
<td>Standard-purity water for photo-voltaic applications, with potable water influent</td>
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<tr>
<td>Make-up Stage Capacity</td>
<td>5, 10, or 17 M³/hour</td>
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<tr>
<td>Polishing Stage Capacity</td>
<td>Variable, according to client-demand</td>
</tr>
</tbody>
</table>
| Influent Water Specification¹ | • Temperature: 5-20 °C, pH: 6.5-8<br>
|                       | • Pressure: 70 – 100 psig (5-7 barg)<br>
|                       | • Total Dissolved Solids (TDS): ≤ 250 mg/L<br>
|                       | • Total Organic Carbon (TOC): ≤ 1 mg/L<br>
|                       | • Copper (Cu) and Iron (Fe): ≤ 0.05 mg/L each<br>
|                       | • German Hardness (GH): ≤ 20°                                               |
| Effluent Water Quality, Point-of-Supply² | • Conductivity: ≤ 0.1 μS/cm<br>
|                       | • Resistivity: ≥ 10 MΩ cm<br>
|                       | • TOC: ≤ 200 ppb<br>
|                       | • Silica: ≤ 50 ppb<br>
|                       | • Pressure: 80 ± 5 psig (5.5 ± 0.5 barg)<br>
|                       | • Final Filtration: 0.2 μm                                                                  |

¹Maximum impurity levels allowable for influent water in order to meet effluent quality levels