**General Information about UV Disinfection**

Disinfection is an essential stage in modern water treatment. To an ever-increasing extent, UV disinfection is being used because it is a safe, chemical-free and reliable disinfection process.

In UV disinfection, the water to be treated is radiated with ultraviolet light. The whole process, therefore, is a purely physical and chemical-free means of water disinfection.

Short wave UV-C radiation (200-280 nm) has strong disinfecting properties, particularly radiation in the wavelength range of 240 to 280 nm.

The UV-C radiation directly attacks the life-critical DNA in bacteria. The radiation initiates a photochemical reaction in DNA and thereby destroys the heredity information contained within it. The bacteria loses its capacity to reproduce and is eradicated.

The advantages of UV disinfection are manifold:

- Immediate and reliable eradication of bacteria without the addition of chemicals.
- No THM or AOX production, no other undesirable by-products.
- No odor or taste effect on the water.
- No storage or handling of chemicals required.
- pH value is not affected by disinfection process.
- No reaction tank/period necessary.
- Low space requirement.
- Low investment and operating costs with high level of reliability and performance.

**Applications for Dulcodes UV Disinfection Systems**

ProMinent® UV disinfection systems are used throughout the world for various applications.

- **Residential and Municipal water treatment** for the disinfection of drinking water.
- **Food and beverage industry** for the eradication of bacteria in water required for the production of food and beverage and for disinfection of process water.
- **Countering legionella in hot water systems.**
- **Unused ozone destruction without activated carbon.**
- **Pharmaceutical and cosmetics industry** for maintaining the high microbiological standards in production water.
- **Semi-conductor industry** for DOC reduction and maintaining the high microbiological standards in production water.
- **Reverse osmosis systems** for permeate disinfection.
- **Communal purification systems** for reducing the fouling rate in purification system drains; and for reducing the fouling rate in the process water extracted from the purification system.
- **Air conditioning systems** for disinfecting the circulating water in humidifiers and cooling towers.
- **Horticulture** for disinfecting watering water.
- **Spa pools** for disinfecting pool water.
- **Swimming pools** for chloramine decomposition in pool water.

**ProMinent® UV Disinfection Systems**

ProMinent® Dulcodes UV Disinfection Systems comprise essentially:

- High quality, bead blasted stainless steel radiation chambers (DIN 1.471 and/or ANSI 316 T1).
- Easily removable lamp protection tubes made of high grade quartz, connected on one side.
- High flux UV-C lamps with 4 pin ceramic plugs.
- Highly selective long term and temperature stable UVC sensors.
- UV system controllers and modern electronic ballasts built into a control cabinet.
The special features of our Dulcodes UV disinfection systems are:

- Even radiation of the entire water flow via the optimized system hydraulics, ensuring outstanding disinfection results.
- Optimized inflow.
- High turbulence longitudinal flow past UV radiation.
- Use of UV low-pressure lamps with long operating life and with high yield of UV-C of wavelength 254 nm (effective for disinfection).
- Use of the UV low pressure lamps with UV-C capacity largely unaffected by water flow.
- Individual lamp monitoring.
- System controller with extensive monitoring and indicating functions.
- Display of all important operating parameters and indication of failures in clear text, trend displays of actual progress of the UV sensor signal. By this means the lamp aging, deposition build-up on the lamp protection tubes or variation in the water quality can be easily monitored.
- Use of modern electronic ballasts with bus technology for gentle lamp ignition and operation. Ensures a long lamp operating life.
- Optional connection to the controller of automatic stop valve and an automatic flushing valve.

**ProMinent® - An Expert Partner In The Field of UV Disinfection**

ProMinent® offers technical support to ensure the safe installation of a Dulcodes UV disinfection system:

- On site evaluation by trained, qualified service staff.
- System planning and design.
- Commissioning and system maintenance by our trained service technicians.

**ProMinent® UV Disinfection Systems**

ProMinent® offers a variety of UV disinfection systems for various applications. The following is a partial list of our supply range.

<table>
<thead>
<tr>
<th>Dulcodes Type</th>
<th>Lamp power (W)</th>
<th>Supply power (W)</th>
<th>Length of radiation chamber in. (mm)</th>
<th>Minimum space available for lamp replacement in. (mm)</th>
<th>Diameter in. (mm)</th>
<th>Shipping weight/operating weight approx. lbs (kg)</th>
<th>Nominal connector diameter in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>16P/11/3/4&quot;</td>
<td>16</td>
<td>30</td>
<td>15.0 (382)</td>
<td>13.8 (350)</td>
<td>4.5 (114)</td>
<td>13-22 (6-10)</td>
<td>3/4</td>
</tr>
<tr>
<td>45P/11/5/4&quot;</td>
<td>45</td>
<td>60</td>
<td>37.0 (940)</td>
<td>35.4 (900)</td>
<td>4.5 (114)</td>
<td>22-44 (10-20)</td>
<td>1-1/4</td>
</tr>
</tbody>
</table>

Dulcodes compact UV disinfection systems are used to disinfect drinking and industrial waters and can be used, depending on transmission, at flow rates from 4.4 to 17.6 gpm (1 to 4 m³/h).

The ballast and controller are contained in a compact housing. The controller has a contact output for connection to a stop valve or a fault-indicating device.

The systems have a high performance, calibratable UV sensor whose signal is displayed graphically. The display also gives the total number of operating hours and the number of times the lamps have been switched on.

This series incorporates standard low-pressure lamps with an operating life of 10,000 hours.
Dulcodes UV disinfection systems are used to disinfect drinking and industrial waters and can be used, depending on transmission, at flow rates from 22 to 1760 gpm (5 to 400 m³/h). Higher capacities are available on request.

This series uses very high-performance low-pressure lamps which minimizes the number of lamps required, enabling the radiation chambers to have a compact design. These high-performance lamps have an operating life of 8,000 - 10,000 hours.

The ballasts are equipped with a BUS interface via which the lamps are ignited and monitored to ensure correct burning. The lamp current can be varied via the BUS interface, permitting a gentle ignition process and precise adjustment to the optimum lamp operating current. The lamp current can thereby be increased slightly at very cold water temperatures <36°F (<8°C). In the case of systems with multiple lamps, individual lamps are monitored via the BUS interface. Should a lamp fail, the stop valve will close.

Dulcodes UV systems are fitted with a long term-stable UVC sensor to monitor the disinfection capacity of the lamps and to monitor the transmission (UV admission) of the water.

The UV system controller incorporates a large graphic display showing the sensor signal. This trend display indicates lamp aging, scale on the lamp protection tube or changes in the water quality within a time window. Horizontal lines indicate safety and warning thresholds.

After starting the UV system, the flushing valve opens for the initial flushing phase once the UVC capacity has exceeded the safety threshold. After the initial phase the stop valve opens automatically.

A warning signal is given if the UVC capacity falls below the warning threshold during normal operation. If the UVC capacity falls below the safety threshold, the stop valve closes and the flushing valve opens.

Dulcodes UV disinfection systems also incorporate a variable free flushing phase. If the UVC capacity rises again within a certain time the system recommences normal operation.
### Dulcodes UV Disinfection Systems With High Flux Lamps

<table>
<thead>
<tr>
<th>Dulcodes Type</th>
<th>Lamp power (W)</th>
<th>Supply power (W)</th>
<th>Length of radiation chamber in. (mm)</th>
<th>Minimum space avail. for lamp replacement in. (mm)</th>
<th>Diameter in. (mm)</th>
<th>Shipping weight/operating weight approx. lbs (kg)</th>
<th>Nominal connector diameter in.</th>
</tr>
</thead>
<tbody>
<tr>
<td>80W/11/5/4&quot;</td>
<td>80</td>
<td>100</td>
<td>24.8 (630)</td>
<td>23.6 (600)</td>
<td>4.5 (114)</td>
<td>18-31 (8-14)</td>
<td>1-1/4</td>
</tr>
<tr>
<td>130W/11/2&quot;</td>
<td>130</td>
<td>150</td>
<td>37.0 (940)</td>
<td>35.4 (900)</td>
<td>4.5 (114)</td>
<td>22-44 (10-20)</td>
<td>2</td>
</tr>
<tr>
<td>230W/130/DN 65</td>
<td>230</td>
<td>250</td>
<td>58.5 (1486)</td>
<td>55.1 (1400)</td>
<td>5.5 (140)</td>
<td>53-101 (24-46)</td>
<td>2-1/2</td>
</tr>
<tr>
<td>2*230W/21/DN 125</td>
<td>2*230</td>
<td>500</td>
<td>64.6 (1640)</td>
<td>59.1 (1500)</td>
<td>8.7 (220)</td>
<td>90-212 (41-96)</td>
<td>5</td>
</tr>
<tr>
<td>3*230W/27/DN 150</td>
<td>3*230</td>
<td>750</td>
<td>65.6 (1665)</td>
<td>59.1 (1500)</td>
<td>10.7 (273)</td>
<td>117-304 (53-138)</td>
<td>6</td>
</tr>
<tr>
<td>4*230W/32/DN 200</td>
<td>4*230</td>
<td>1000</td>
<td>66.5 (1690)</td>
<td>63.0 (1600)</td>
<td>12.8 (324)</td>
<td>143-331 (65-150)</td>
<td>8</td>
</tr>
<tr>
<td>5*230W/32/DN 200</td>
<td>5*230</td>
<td>1200</td>
<td>66.5 (1690)</td>
<td>63.0 (1600)</td>
<td>12.8 (324)</td>
<td>154-419 (70-190)</td>
<td>8</td>
</tr>
<tr>
<td>6*230W/32/DN 200</td>
<td>6*230</td>
<td>1400</td>
<td>70.5 (1790)</td>
<td>63.0 (1600)</td>
<td>16.0 (406)</td>
<td>165-441 (75-200)</td>
<td>8</td>
</tr>
<tr>
<td>7*230W/40/DN 250</td>
<td>7*230</td>
<td>1700</td>
<td>75.6 (1920)</td>
<td>63.0 (1600)</td>
<td>16.0 (406)</td>
<td>254-683 (115-310)</td>
<td>10</td>
</tr>
<tr>
<td>8*230W/40/DN 250</td>
<td>8*230</td>
<td>1900</td>
<td>75.6 (1920)</td>
<td>63.0 (1600)</td>
<td>16.0 (406)</td>
<td>254-683 (115-310)</td>
<td>10</td>
</tr>
<tr>
<td>9*230W/40/DN 250</td>
<td>9*230</td>
<td>2100</td>
<td>75.6 (1920)</td>
<td>63.0 (1600)</td>
<td>16.0 (406)</td>
<td>287-705 (130-320)</td>
<td>10</td>
</tr>
<tr>
<td>10*230W/40/DN 250</td>
<td>10*230</td>
<td>2400</td>
<td>75.6 (1920)</td>
<td>63.0 (1600)</td>
<td>16.0 (406)</td>
<td>287-705 (130-320)</td>
<td>10</td>
</tr>
<tr>
<td>11*230W/40/DN 250</td>
<td>11*230</td>
<td>2600</td>
<td>75.6 (1920)</td>
<td>63.0 (1600)</td>
<td>16.0 (406)</td>
<td>287-705 (130-320)</td>
<td>10</td>
</tr>
<tr>
<td>12*230W/40/DN 250</td>
<td>12*230</td>
<td>2800</td>
<td>75.6 (1920)</td>
<td>63.0 (1600)</td>
<td>16.0 (406)</td>
<td>287-705 (130-320)</td>
<td>10</td>
</tr>
</tbody>
</table>

#### Diagram

- **Inlet**: central inlet
- **Outlet**: the entire length of the lamp is exploited
- **Radiation area**
- **UVC - selective sensor**
- **Perforated plate for turbulence production**
- **Homogenous radiation**
- **Optimum flow distribution**
- **Optimum exposure to entire lamp length**
ProMinent® Dulcodes
UV Disinfection Systems (cont.)

Custom Versions of the Dulcodes UV Disinfection System

ProMinent offers a wide range of custom versions of the Dulcodes UV disinfection system:

The K series is used for the disinfection of salt waters (thermal water, brine). Its radiation chambers are made of high-performance plastic and special welding processes ensure optimum pressure-resistance (can be used up to operating pressures of 58 psi (4 bar).

Typical applications include the disinfection of filter back washing water in brine swimming pools or to reduce deposition on the input side of reverse osmosis systems in systems used to reclaim drinking water from brine.

This series covers flow rates from 31 to 396 gpm (7 to 90 m³/h) (at transmission value 90% and a dose of 400 J/m²). Larger flow rates can be accommodated on request.

The D series is ideal for the disinfection of waters containing a high level of dissolved solids, or colored industrial or wastewater. Its radiation chambers are designed as thin-layer systems and cover flow rates from 4.4 to 132 gpm (1 to 30 m³/h) (at transmission value 70 and a dose of 400 J/m²).

Additional custom versions already in use:

- For pharmaceutical use: ProMinent offers electro-polished custom versions of the UV disinfection system with particularly fine surface finish <0.031 in. (<0.8 mm).
- UV systems for the decomposition of chloramines in swimming pool water are an alternative to metering powdered carbon or an ozonating stage.
- UV systems for unused ozone destruction and the decomposition of chlorine or chlorine dioxide are an alternative to using an activated carbon filter.
- UV systems for TOC decomposition in super-clean water with special lamps.
## Custom Versions of the Dulcodes UV Disinfection System

<table>
<thead>
<tr>
<th>Dulcodes Type</th>
<th>Lamp power (W)</th>
<th>Supply power (W)</th>
<th>Length of radiation chamber (in. (mm))</th>
<th>Minimum space avail. for lamp replacement (in. (mm))</th>
<th>Diameter (in. (mm))</th>
<th>Shipping weight/approx. lbs (kg)</th>
<th>Nominal connector diameter (DN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>45D/9/1&quot;</td>
<td>45</td>
<td>60</td>
<td>37 (940)</td>
<td>35.4 (900)</td>
<td>3.5 (89)</td>
<td>22-33 (10-15)</td>
<td>1&quot;</td>
</tr>
<tr>
<td>130D/9/1&quot;</td>
<td>130</td>
<td>150</td>
<td>37 (940)</td>
<td>35.4 (900)</td>
<td>3.5 (89)</td>
<td>22-33 (10-15)</td>
<td>1&quot;</td>
</tr>
<tr>
<td>1*230D/9/DN 65</td>
<td>1’230</td>
<td>250</td>
<td>59 (1500)</td>
<td>55.1 (1400)</td>
<td>3.5 (89)</td>
<td>40-55 (18-25)</td>
<td>2-1/2 (65)</td>
</tr>
<tr>
<td>2*230D/9/DN 65</td>
<td>2’230</td>
<td>500</td>
<td>59 (1500)</td>
<td>55.1 (1400)</td>
<td>3.5 (89)</td>
<td>79-110 (36-50)</td>
<td>2-1/2 (65)</td>
</tr>
<tr>
<td>3*230D/9/DN 66</td>
<td>3’230</td>
<td>750</td>
<td>59 (1500)</td>
<td>55.1 (1400)</td>
<td>3.5 (89)</td>
<td>119-165 (54-75)</td>
<td>2-1/2 (65)</td>
</tr>
<tr>
<td>4*230D/9/DN 66</td>
<td>4’230</td>
<td>1000</td>
<td>59 (1500)</td>
<td>55.1 (1400)</td>
<td>3.5 (89)</td>
<td>159-220 (72-100)</td>
<td>2-1/2 (65)</td>
</tr>
</tbody>
</table>
# Questionnaire for the Design of a UV Disinfection System

**Project/Date**

---

**Client**

---

**Correspondent**

---

## Application of disinfected water

- [ ] Drinking water (private water supply)
- [ ] Drinking water (hot water supply)
- [ ] Production water in the pharmaceutical or cosmetic industries
- [ ] Ventilation and air conditioning plant
- [ ] Fish farming
- [ ] Other

- [ ] Drinking water (mains water supply)
- [ ] Production water in the food and drinks industries
- [ ] Ultrapure water
- [ ] Horticultural watering system
- [ ] Operation water in sewage plant

## Source of water to be disinfected

- [ ] Main water supply
- [ ] Spring
- [ ] Rain water
- [ ] Sea water
- [ ] Circulating water
- [ ] Other

- [ ] Well
- [ ] Surface ground water
- [ ] Reverse osmosis
- [ ] Wastewater from sewage plant

## Raw water pre-treatment

- [ ] Sand filtration
- [ ] Micro filtration
- [ ] Iron removal
- [ ] Total desalination
- [ ] Dosing with

- [ ] Fioculation filtration
- [ ] Softening
- [ ] Manganese removal

- [ ] Other

## Maximum water flow limited

- [ ] by pump capacity
- [ ] by restrictor
- [ ] Other

- [ ] by yield of well
- [ ] by sampling station
### Questionnaire for the Design of a UV Disinfection System

#### Design of UV disinfection system

- **Maximum water flow**: ________ gpm (m³/h)
- **Minimum UV transmission at 254 nm**: ___________% /1 cm ___________% /10cm ___________ SAK 254 nm
- **Exposure dose at the end of the lamp operating life**:  
  - [ ] 300 J/m²  
  - [ ] 400 J/m²  
  - [ ] _____ J/m²  
  - [ ] unused ozone removal
- **Water temperature**:  
  - [ ] 37 - 104°F (3 - 40°C)  
  - [ ] 104 - 167°F (40 - 75°C)  
  - [ ] _____ to _____ °F (°C)
  - [ ] "Steam resistant" option

#### Operating pressure
- [ ] PN 10 (standard version)  
- [ ] PN _________

#### Connector
- [ ] Standard connector (see technical documentation)
- [ ] Flange in. (DN) ______
- [ ] Pipe thread _____________ inch
- [ ] Other connection __________________________________________

#### Water analysis
- [ ] Supplied  
- [ ] Will be supplied later

#### System design

**Radiation chamber material**
- [ ] Standard version in stainless steel (see technical documentation)
- [ ] Chloride-resistant stainless steel, chloride _____________ mg/L
- [ ] Other _____________

**Radiation chamber version** (see also system designs)
- [ ] Standard version (see technical documentation)
- [ ] Version A
- [ ] Version B
- [ ] Version C
- [ ] Version D
- [ ] Version E
- [ ] Version F

**Power supply**
- [ ] 230 V
- [ ] 400 V
- [ ] _____ V
- [ ] 50 Hz
- [ ] 60Hz

**Controller**
- [ ] At control cabinet (standard version)
- [ ] Away from control cabinet, desired distance _____________ ft. (m)
- [ ] The following directives and regulations etc. must be adhered to _____________________________________________
- [ ] The following additional documentation is also required _____________________________________________
ProMinent® Dulcodes
The Design of a UV Disinfection System

Questionnaire for the Design of a UV Disinfection System

Project / Date __________________________________________________________________________________________

Water quality □ Constant □ Fluctuating

Total hardness __________ mmol/L ___________ ºdH or mgCaC03/L ___________
Carbonate hardness ______ mmol/L ______ ºdH or mgCaC03/L ______
Chloride __________ mg/L
Manganese ___________ mg/L
Iron ___________ mg/L
Potassium permanganate consumption __________ mg/L

Appearance □ Clear □ Cloudy □ Colored □ ___________

UV transmission at 254 nm ___________ % / 1 cm
_________________________ % / 10 cm
_________________________ SAK 254 nm

Opacity ___________ FTU
Suspended solids content 72ºF (22ºC) ___________ mg/L

Total colony count 72ºF (22ºC) ___________ cfu/mL (colony forming units mL)
Total micro-biological count 99ºF (37ºC) ___________ cfu/mL (colony forming units mL)
Coliforms ___________ cfu/mL (colony forming units mL)

Parasites □ Present □ Not Present
Algae □ Present □ Not Present

□ Comments
_____________________________________________________________________________________
_____________________________________________________________________________________

UV-9