Single-Pass Tangential Flow Filtration Made Simpler

Single-pass tangential flow filtration (SPTFF) is revolutionizing how tangential flow filtration (TFF) is implemented in biotech, vaccine, blood plasma and other applications. Pall has now made it even easier to implement this breakthrough patented technology into your process. As with the original Cadence SPTFF modules, the Cadence Inline Concentrator (ILC) allows direct flow through in-process volume reduction and can be implemented into a process system or operated as a stand alone unit.

This exciting new technology leads to economic and practical benefits, including:

- Ability to couple the concentration of product before or after other downstream processing (DSP) steps, consequently optimizing other steps and reducing in-process pool tank volumes
- Continuous processing in DSP
- Easy integration of the assembled module, allowing plug-and-play
- Potential reduction of product damage or aggregation due to reduced residence time and shear exposure
Benefits include:

- Easy connection to a pressure source, like a pump or pressure vessel
- Simplified in-process volume reduction
- Continuous processing enabled by process coupling
- The module feed, retentate and permeate ports are easily connected to the appropriate outlets using clearly marked ports

**Product Platform**

Innovative SPTFF processing takes place within the Cadence ILC modules. The modules incorporate Pall’s proven T-series cassettes with Delta or Omega membrane, and are available in different formats to accommodate various processing volumes.

These products utilize proprietary technology, as well as technology licensed from SPF Innovations, and may be covered by one or more patents. See pall.com/patents.

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**Optimize Economic and Operational Benefits**

**Enhance downstream processing to increase capacity and reduce costs**

Cadence ILC modules can help to eliminate or reduce the size of intermediate storage tanks and associated cleaning of tanks when used for in-process volume reduction before or after existing steps.

**Enable in-process volume reduction**

Depending on the initial concentration and product characteristics, a volume reduction of 2 to 4X (or higher) can be achieved with minimal instrumentation or system requirements.

**Optimize processing of highly shear-sensitive products**

Processing with the Cadence ILC results in only one pass through the pump and module, reducing shear exposure. For products sensitive to pumping, the pump can be completely eliminated by using pressurized vessels to flow the process fluid through the module. Further benefits are achieved by eliminating any mixing or foaming issues associated with the feed tank.

**No holder required**

Cadence ILC modules are provided assembled, and the cassettes and manifolds are pre-torqued between two end plates so that no extra holder is required.

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The preassembled Cadence ILC modules do not need a holder. Once the feed port is connected to a pressurized feed source, the module is ready for use. The built-in resistor in the retentate manifold eliminates the need for downstream instrumentation and allows volume reduction of 2 to 4X (or higher), depending on the application.

Similar to other Cadence SPTFF devices, the Cadence ILC utilizes standard Pall T-Series cassettes as the building blocks for the module. These modules are offered with either Delta regenerated cellulose or Omega polyethersulfone (PES) 10 kDa or 30 kDa membranes providing the high flux, high selectivity and low protein binding characteristics associated with these membranes. They are available in a range of size formats to accommodate various processing volumes.

These products utilize proprietary technology, as well as technology licensed from SPF Innovations, and may be covered by one or more patents. See pall.com/patents.
**Specifications**

The operating conditions for any SPTFF process must be established by performing trials and analyzing results. Pall's technical service group is available to assist in conducting trials to develop operating conditions necessary to achieve the desired process objectives.

**Materials of Construction**

<table>
<thead>
<tr>
<th>Cassette</th>
<th>Delta regenerated cellulose or Omega PES membrane, 10 kDa or 30 kDa with polypropylene screens, polyurethane encapsulant with white pigment (TiO₂), and medical grade silicone for the permeate seals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gaskets</td>
<td>Medical grade, platinum-cured silicone</td>
</tr>
<tr>
<td>Manifold plates</td>
<td>Ultra high molecular weight polyethylene (UHMWPE)</td>
</tr>
</tbody>
</table>
| Tubing and connectors | • Tubing: pharmaceutical grade platinum-cured silicone  
• T01/T02 - female Luer connection and cap: polypropylene (PP)  
• T12 - MPC quick disconnect connector and plug: polysulfone (PS)  
• T06 - MPX quick disconnect connector and plug: polysulfone |

**Operating Limits**

<table>
<thead>
<tr>
<th>Maximum pressure</th>
<th>4.1 barg (60 psig)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum transmembrane pressure (TMP)</td>
<td>4.1 barg (60 psig)</td>
</tr>
</tbody>
</table>
| Processing temperature range | • 20 – 25 °C for extended use (freezing will damage module)  
• Up to 40 °C for 4 hour cleaning |
| pH range          | 2 – 13 |

**Typical Feed Flow Rates**

<table>
<thead>
<tr>
<th>Cadence ILC Module Format</th>
<th>Membrane Area (m²)</th>
<th>Q_{FEED} (L/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>T01</td>
<td>0.065</td>
<td>0.05 – 0.3</td>
</tr>
<tr>
<td>T02</td>
<td>0.13</td>
<td>0.1 – 0.7</td>
</tr>
<tr>
<td>T12</td>
<td>0.7</td>
<td>0.6 – 3.5</td>
</tr>
<tr>
<td>T06</td>
<td>3.5</td>
<td>2.9 – 17.5</td>
</tr>
</tbody>
</table>

**Integrity Test**

<table>
<thead>
<tr>
<th>Module</th>
<th>Feed flow rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta membrane module</td>
<td>&lt; 538 sccm/m² (&lt;50 sccm/ft²) at 4.1 barg (60 psig)</td>
</tr>
<tr>
<td>Omega membrane module</td>
<td>&lt;1600 sccm/m² (&lt;150 sccm/ft²) at 2.1 barg (30 psig)</td>
</tr>
</tbody>
</table>

Each Cadence ILC module has a unique serial number for full traceability.
**Shelf Life**

The shelf life of Cadence inline concentrator packaged in preservative is 1 year from the date of manufacture when the modules are stored unopened in the original packaging at temperature up to 25 °C and protected from direct light. Extended shelf life studies are ongoing. Please contact Pall for updated information.

**Biological Safety**

The materials of construction for Cadence ILC modules have been tested and meet the requirements for the Biological Reactivity Tests listed in the United States Pharmacopeia (USP) under USP <88> for Class VI - 70 °C Plastics.

**Documentation**

Each module is supplied with the following comprehensive documentation to ensure the Cadence ILC module is operated successfully. Visit www.pall.com/biotech or contact your local Pall representative to obtain these documents.

- Certificate of quality
- Material and safety data sheet (MSDS) for the module preservative solution
- Care and use manual
- Validation guide
- Application notes

Additional services include:

- Validation service for your specific tests such as compatibility testing with your product fluid
- Training and technical support to optimize your process using Cadence ILC modules

Please contact Pall for further information.

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**Performance**

**Figure 1**

Feed flux excursion test results: volume concentration factor (VCF), feed pressure as function of feed flux, 10 g/L human IgG feed solution, T01 (0.065 m²) Cadence ILC module

The range of operating VCF can be determined for a specific feed solution by doing a feed flux excursion.
**Ordering Information**

Identify and order Cadence inline concentrator modules using the table below.

### Guide to Cadence Inline Concentrator Module Part Numbers

<table>
<thead>
<tr>
<th>Delta Membrane</th>
<th>Omega Membrane</th>
<th>Cassette Format</th>
<th>Membrane Area (m²)</th>
<th>MWCO (kDa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ILD010T010407</td>
<td>ILO S010T010407</td>
<td>T01</td>
<td>0.065</td>
<td>10</td>
</tr>
<tr>
<td>ILD010T020407</td>
<td>ILO S010T020407</td>
<td>T02</td>
<td>0.13</td>
<td></td>
</tr>
<tr>
<td>ILD010T120407</td>
<td>ILO S010T120407</td>
<td>T12</td>
<td>0.7</td>
<td></td>
</tr>
<tr>
<td>ILD010T060407</td>
<td>ILO S010T060407</td>
<td>T06</td>
<td>3.5</td>
<td></td>
</tr>
<tr>
<td>ILD030T010407</td>
<td>ILO S030T010407</td>
<td>T01</td>
<td>0.065</td>
<td>30</td>
</tr>
<tr>
<td>ILD030T020407</td>
<td>ILO S030T020407</td>
<td>T02</td>
<td>0.13</td>
<td></td>
</tr>
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<td>ILO S030T120407</td>
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<td>T06</td>
<td>3.5</td>
<td></td>
</tr>
</tbody>
</table>

For example, a T01 module with 0.065 m² (0.7 ft²) of 10 kDa Delta regenerated cellulose membrane area is part number ILD010T010407.

### Cadence Inline Concentrator Part Numbers

- **IL** - Inline concentrator
- **D** or **OS** - Cassette with Delta regenerated cellulose membrane or Omega PES membrane
- **010 or 030** - Nominal molecular weight cut-off (MWCO) in kDa
- **T01, T02, T12 or T06** - Cassette format
- **04** - Number in series
- **07** - Number of cassettes

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