Cycling Refrigerated Compressed Air Dryers

Leading the Way in Air Purification

As one of the world’s leading manufacturers of compressed air purification equipment, Donaldson has built a comprehensive engineering, manufacturing, and customer support network to meet the most demanding applications. With over 30 years of expertise in compressed air filtration and separation technologies, Donaldson manufactures a complete line of drying and filtration equipment using innovative designs that focus on energy efficient operation and reliable performance. Donaldson offers two distinct ranges of refrigerated dryers – a cycling and a non-cycling range to meet all your application requirements.

**Cycling range**
- RFC Series (200 - 650 scfm)
- DVF Series (800 - 2,000 scfm)
- RTM Series (2,500 - 30,000 scfm)*

**Non-cycling range**
- SD Series (10 - 40 scfm)
- VF Series (50 - 2,000 scfm)
- AR Series (2,500 - 10,000 scfm)*

Energy efficient operation is of paramount importance to any industrial machine and the process it supports. The RFC dryer line, with Ultrapulse control, and the DVF digital scroll series, offer the latest in energy-saving technology up to 2,000 scfm. While the competition is trying to catch up to the efficiency of our components and assemblies – like our patented aluminum block heat exchangers – the Donaldson engineers focus on the brains of every state-of-the-art refrigerated dryer – the controller.

The intelligent control of our dryers, and the reliable operation and attractive design, are key points in customers staying with Donaldson, once they have experienced the quality of our products and services.

**Ozone-safe, 100% chlorine free, R-134a refrigerant as standard:**
Donaldson uses R-134a refrigerant in all refrigerated compressed air dryers as standard. R-134a has become the industry’s choice as the preferred refrigerant because of its ozone depletion factor of 0.0 and low global warming potential. R-134a is a one-blend refrigerant and, therefore, consistent in performance (no temperature glide) and easy to service (no mixture of different refrigerants).

All Donaldson dryers are designed to give our customers the best value available in the industry – reliable performance to CAGI ADF 100 specification while consuming the lowest amount of energy possible.

* For more information on the Donaldson RTM cycling dryers and the non-cycling range, please refer to respective brochures.
A combination of high quality components, intelligent control logic, and taking advantage of real-world operating conditions allows our cycling refrigerated compressed air dryer to provide consistent premium air quality at the lowest possible cost.

Whether you look at the actual compressed air consumption or take the ambient conditions into consideration, most dryers actually run less than 5% of their operating time at full capacity.

With this in mind, please look into investing in an energy-saving dryer, which can help you save money in the long run.

Different technologies act differently in less than full capacity conditions. If demand runs at only 30%, why pay for 60% or 100%? The Donaldson RFC and DVF series dryers have optimized partial load performance to maximize your saving!

High quality components, such as the aluminum block heat exchangers, advanced control logic, and a design that achieves extremely low differential pressures make the RFC and DVF dryers the best in the industry.
Donaldson RFC Series Dryers utilize a microprocessor-based controller to turn the refrigerant compressor on and off based on actual load conditions. The controller has been programmed to not only measure and respond to critical operating parameters, but to track (up to 8 times per second) and anticipate demand. This ability to proactively encounter load changes and adjust the operating cycle accordingly sets the RFC series dryers apart from the competition.

The energy storage capacity of the aluminum block heat exchanger ensures that RFC dryers can react quickly and avoid dew point spikes (sudden increases in dew point beyond acceptable limits) commonly associated with cycling dryers, while operating in the most energy efficient cycle.

Features of the RFC Ultrapulse Microprocessor Controller:

**Digital Display**
- Dew point readout
- Operating mode
- Total hour meter
- Percent time loaded
- Current energy consumption %
- Refrigerant compressor running
- Maintenance interval exceeded
- System interruption indicator
- High-pressure alarm and shutdown
- Alarm history

**Function Keys**
- On/Off switch
- Data selector key
- Drain key

**Diagnostic Codes**
- F1 Check ambient sensor
- F2 Check dew point sensor
- EH EPROM irregularity
- FH Refrigerant overpressure
- EU Low voltage
- H1 Dew point too high
- L1 Dew point too low
Cycling Refrigerated Compressed Air Dryers

How the RFC Series Works

Only the highest quality components are used in Donaldson refrigerated compressed air dryers. The compressors are specifically selected to work within the energy-saving cycling design of the RFC series. Along with the high efficiency aluminum block heat exchanger that not only provides excellent heat transfer, but also acts as the storage medium to cool down the air, these dryers provide consistent dew point performance within the specification.

The three-stage aluminum block heat exchanger combines an integral air-to-air heat exchanger, a condensate separator and the air-to-refrigerant heat exchanger. The ability to store and release cooling energy adds to the power efficiency of the RFC Ultrapulse dryers.

Dimensions & Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Capacity @ CAGI* (scfm)</th>
<th>Capacity @ ISO** (scfm)</th>
<th>Connection (inches NPT)</th>
<th>HP Installed (size)</th>
<th>KW (full load) for CAGI conditions</th>
<th>KW (full load) for ISO conditions</th>
<th>Full Load Amps</th>
<th>Voltage (Standard)</th>
<th>Dimensions (inches)</th>
<th>Pressure max. (psig)</th>
<th>Weight (lbs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFC-200</td>
<td>200</td>
<td>236</td>
<td>2</td>
<td>2-1/4</td>
<td>1.80</td>
<td>1.60</td>
<td>4.2</td>
<td>460-3-60</td>
<td>49</td>
<td>35</td>
<td>32</td>
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<tr>
<td>RFC-250</td>
<td>250</td>
<td>295</td>
<td>2</td>
<td>2-1/4</td>
<td>1.94</td>
<td>1.78</td>
<td>4.2</td>
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<td>35</td>
<td>32</td>
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<tr>
<td>RFC-300</td>
<td>300</td>
<td>354</td>
<td>2</td>
<td>2-1/4</td>
<td>2.04</td>
<td>1.88</td>
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<td>RFC-350</td>
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<td>413</td>
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<td>2.07</td>
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<td>49</td>
<td>35</td>
<td>32</td>
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<td>531</td>
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<td>49</td>
<td>35</td>
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<tr>
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<td>649</td>
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<td>35</td>
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<td>RFC-650</td>
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<td>767</td>
<td>2-1/2</td>
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<td>4.79</td>
<td>4.45</td>
<td>9.1</td>
<td>460-3-60</td>
<td>49</td>
<td>35</td>
<td>32</td>
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</tbody>
</table>

* Capacity rated in accordance with CAGI ADF 100 @ 100 psig, 100°F inlet, 100°F ambient, and a PDP of 38°F
** Capacity rated in accordance with ISO 7183 @ 7 bar (101.5 psig), 35°C (95°F) inlet, 25°C (77°F) ambient and a PDP of 3°C (37.4°F)

Ambient air temperature: 35*-120°F, inlet air temperature: 140°F max., operating pressure: 250 psig max.
Donaldson DVF Series Dryers utilize digital scroll compressors to modulate between 10% and 100% capacity.

The programmable logic controlled (PLC) modulation provides a near linear power reduction when unloaded, which results in a highly consistent performance pattern during load variations.

Using our patented Variable Flow aluminum block heat exchanger design, the DVF dryers provide the high separation efficiency our customers have come to expect from Donaldson dryers.

This combination of highest quality components and highly advanced PLC controls, provide the most energy efficient compressed air drying system in the 800-2000 scfm range.

**Why Choose Digital Scroll?**

**Efficiency**
- Scroll compressors achieve **100% volumetric efficiency** during the compression process.
- Digital technology provides **precision capacity control** that reduces power consumption linearly.

**Reliability**
- The scroll design offers **superior liquid handling capabilities** and requires no tip seals that wear out.

**Quiet Operation with Less Vibration**
- Several pockets of gas are compressed simultaneously, providing nearly continuous compression cycles for **smooth and quiet operation**.

![Digital Power Reduction Chart](chart.png)

*Testing data chart provided by Copeland Refrigeration.*
Simply put, one scroll remains stationary while the other one orbits around it.

- Gas enters the outer opening as one scroll orbits the other.
- The open passage is sealed as gas is drawn into the compression chamber.
- As one scroll continues orbiting, the gas is compressed into an increasingly smaller “pocket.”
- Gas is continually compressed to the center of the scrolls, where it is discharged through precisely machined ports and returned to the system.
- During actual operation, all passages are in various stages of compression at all times, resulting in near-continuous intake and discharge.

How the DVF Heat Exchanger Works

Hot, saturated compressed air is first precooled by exiting cold air in the air-to-air heat exchanger. The precooled air then enters the evaporator where it is cooled to its final dew point. The mixture of cold air and condensation flows into the three-stage separator/demister where liquids and contaminants are reliably removed and ejected from the system via a programmable timer drain valve. The cold air is then reheated by the incoming hot air before leaving the dryer.
DVF Features & Benefits

- PLC control with ON/OFF switch and power ON light.
- Variable flow capacity from 10% to 100%.
- High efficiency digital scroll refrigeration compressor.
- Anodized aluminum heat exchanger (non-oxidizing).
- Non-velocity sensitive cleanable demister/separator.
- Suitable for high inlet temperature (up to 150°F).
- Ideal for new, energy-efficient, variable speed air compressors.
- Environmentally friendly refrigerant R-134a ensures reliable operation in high ambient overload conditions.
- Lightweight and compact design to ensure easy installation.
- Counter-current, variable flow heat exchanger.
- Low pressure drop for lower operating cost.
- Large surface area for better thermal efficiency.
- Heavy-duty industrial powder coated cabinet with access panel.
- Inlet pressure gauge.

Features of the DVF Programmable Logic Control (PLC)

- Total hour meter
- Energy saving hour meter
- Dryer status: Run/Unload/Standby
- Dew point temperature
- Adjustable electronic drain (On time/OFF time)
- On/Off switch
- Power ON light

Options:

- High dew point alarm
- High inlet temperature alarm
- Common alarm
- Remote start/stop
- Device net communication
- NEMA 4, 12 electrical enclosure
- Low ambient protection
To protect your investment, we recommend that you install a high performance prefilter directly in front of your dryer. By doing this, you will not only ensure trouble-free operation for years to come, but also guarantee that the dryer will operate at its highest efficiency rating throughout its lifetime.

To make the selection easy for you, Donaldson has matched a filter range to the refrigerated dryer offering in connection size and flow rate. The FF grade prefilter is ideally suited for general applications and combines excellent efficiency with a very low differential pressure due to its patented binder-free media.

For critical applications, supplement the package with the addition of an SMF grade filter at the dryer outlet for removal of trace contaminants.

By protecting your equipment and keeping the dryer efficiency at its best, these filters will literally pay you back their cost and more in savings on your monthly energy bill.

Donaldson also offers a limited 5-year warranty on the heat exchanger and compressor if a Donaldson prefilter is installed.

### Dimensions & Specifications

<table>
<thead>
<tr>
<th>Model</th>
<th>Capacity @ CAGI* (scfm)</th>
<th>Capacity @ ISO** (scfm)</th>
<th>Connection (inches NPT)</th>
<th>HP Installed (size)</th>
<th>KW (full load) for CAGI conditions</th>
<th>KW (full load) for ISO conditions</th>
<th>Full Load Amps</th>
<th>Voltage (Standard)</th>
<th>Dimensions (inches)</th>
<th>Pressure max. (psig)</th>
<th>Weight (lbs)</th>
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<tbody>
<tr>
<td>DVF-800</td>
<td>800</td>
<td>944</td>
<td>3</td>
<td>4</td>
<td>3.30</td>
<td>3.06</td>
<td>10.7</td>
<td>460-3-60</td>
<td>48 54 36</td>
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<td>972</td>
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<td>DVF-1000</td>
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<td>1180</td>
<td>3</td>
<td>6</td>
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<td>48 54 36</td>
<td>200</td>
<td>1160</td>
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<td>DVF-1200</td>
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<td>4.79</td>
<td>4.45</td>
<td>11.8</td>
<td>460-3-60</td>
<td>48 54 36</td>
<td>200</td>
<td>1470</td>
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<tr>
<td>DVF-1600</td>
<td>1600</td>
<td>1888</td>
<td>4 FLG</td>
<td>2 x 4</td>
<td>6.00</td>
<td>6.12</td>
<td>22.7</td>
<td>460-3-60</td>
<td>60 65 56</td>
<td>200</td>
<td>2100</td>
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<tr>
<td>DVF-2000</td>
<td>2000</td>
<td>2360</td>
<td>4 FLG</td>
<td>2 x 6</td>
<td>7.50</td>
<td>8.90</td>
<td>25.0</td>
<td>460-3-60</td>
<td>60 65 56</td>
<td>200</td>
<td>2600</td>
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</table>

* Capacity rated in accordance with CAGI ADF 100 @ 100 psig, 100°F inlet, 100°F ambient, and a PDP of 38°F

** Capacity rated in accordance with ISO 7183 @ 7 bar (101.5 psig), 35°C (95°F) inlet, 25°C (77°F) ambient and a PDP of 3°C (37.4°F)

Ambient air temperature: 35°-120°F, inlet air temperature: 140°F max., operating pressure: 200 psig max.

### The Filter that Pays for Itself

To make the selection easy for you, Donaldson has matched a filter range to the refrigerated dryer offering in connection size and flow rate. The FF grade prefilter is ideally suited for general applications and combines excellent efficiency with a very low differential pressure due to its patented binder-free media.

For critical applications, supplement the package with the addition of an SMF grade filter at the dryer outlet for removal of trace contaminants.

By protecting your equipment and keeping the dryer efficiency at its best, these filters will literally pay you back their cost and more in savings on your monthly energy bill.

Donaldson also offers a limited 5-year warranty on the heat exchanger and compressor if a Donaldson prefilter is installed.

### Recommended Prefilters & Afterfilters

<table>
<thead>
<tr>
<th>Dryer Model</th>
<th>Prefilter</th>
<th>Afterfilter</th>
</tr>
</thead>
<tbody>
<tr>
<td>RFC-200 to RFC-350</td>
<td>FF 2”</td>
<td>SMF 2”</td>
</tr>
<tr>
<td>RFC-450 to RFC-650</td>
<td>FF 2-1/2”</td>
<td>SMF 2-1/2”</td>
</tr>
<tr>
<td>DVF-800 to DVF-1200</td>
<td>FF 3”</td>
<td>SMF 3”</td>
</tr>
<tr>
<td>DVF-1600 to DVF-2000</td>
<td>Consult Factory</td>
<td></td>
</tr>
</tbody>
</table>

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**Cycling Refrigerated Compressed Air Dryers**
One revolutionary feature of the Ultrapulse controller is its ability to offer different modes of operation. Depending on the needs of the process and changes in ambient conditions, the user can select the ideal setting to optimize savings.

**Standard Mode**

When operating in Standard Mode, RFC dryers will provide a continuous supply of dry compressed air at 38°F pressure dew point (pdp) while adjusting its cycle to compensate for changes in load, resulting in reduced power consumption. This mode is the default setting, allowing convenient “plug and play” operation.

Enjoy your energy savings while maintaining a 38°F pressure dew point while running in Standard Mode!

**Flex Mode**

The highest level of energy efficiency can be achieved by operating in Flex Mode*. This mode of operation has been developed to address the fact that in many applications the process requires a set level of relative humidity (RH) as opposed to a set dew point.

It has long been established that the rate of pipe corrosion greatly increases when the RH of the process air rises above 50% (for added safety margin, the dryers calculate with an RH of 40%).

Since relative humidity relates to air temperature, the actual dew point of the process air can be allowed to rise above 38°F (Standard Mode), 45°F (Summer Mode) or even higher while still maintaining an RH of 40%. For example, if the actual ambient temperature is 75°F, the dew point can be allowed to rise to 49°F. At 80°F, a pdp of 53°F will provide dry air at an RH of 40%.

By controlling to relative humidity, and allowing the dew point to vary accordingly, very high levels of energy savings can be achieved while preventing liquid condensation in the piping system.

* Flex Mode should only be used if the ambient temperature surrounding the entire compressed air system never falls below the ambient temperature in the vicinity of the dryer itself.

RFC models are equipped with the Ultramat UFM-T zero air-loss condensate drain valve. UFM-T valves assure that no compressed air is lost when condensate is drained, resulting in significant energy savings.
Cycling Refrigerated Compressed Air Dryers

Capacity Correction Factors RFC and DVF Series

The leading manufacturers of compressed air and gas equipment in North America are organized in the Compressed Air & Gas Institute (CAGI). As the premier industry organization, CAGI has developed standards to protect users of this equipment. ADF 100 is the current standard for refrigerated compressed air dryers. ADF 100 specifies the dryers performance to be rated at 100°F inlet temperature, 100°F ambient temperature, and 100° psig system pressure. To adjust the dryer capacity from these “CAGI conditions” to your specific application, please use the correction factors below for differing ambient air temperatures (C1), inlet air temperatures (C2), system pressures (C3), and varying dew point requirements (C4).

### Capacity correction factors for differing ambient air temperature (C1)

<table>
<thead>
<tr>
<th>Ambient Temperature (°F)</th>
<th>70</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>110</th>
<th>115</th>
<th>120</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correction Factor</td>
<td>1.10</td>
<td>1.07</td>
<td>1.05</td>
<td>1.00</td>
<td>0.94</td>
<td>0.85</td>
<td>0.65</td>
</tr>
</tbody>
</table>

### Capacity correction factors for differing inlet air temperature (C2)

<table>
<thead>
<tr>
<th>Inlet Temperature (°F)</th>
<th>80</th>
<th>90</th>
<th>100</th>
<th>110</th>
<th>120</th>
<th>140</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correction Factor</td>
<td>1.50</td>
<td>1.21</td>
<td>1.00</td>
<td>0.82</td>
<td>0.72</td>
<td>0.61</td>
</tr>
</tbody>
</table>

### Capacity correction factors for differing system air pressure (C3)

<table>
<thead>
<tr>
<th>System Pressure (psig)</th>
<th>50</th>
<th>75</th>
<th>100</th>
<th>125</th>
<th>150</th>
<th>175</th>
<th>200</th>
<th>225</th>
<th>250</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correction Factor</td>
<td>0.85</td>
<td>0.95</td>
<td>1.00</td>
<td>1.07</td>
<td>1.13</td>
<td>1.18</td>
<td>1.20</td>
<td>1.22</td>
<td>1.24</td>
</tr>
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</table>

### Capacity correction factors for differing pressure dew point requirements (C4)

<table>
<thead>
<tr>
<th>Dew Point (°F)</th>
<th>38</th>
<th>41</th>
<th>45</th>
<th>50</th>
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</thead>
<tbody>
<tr>
<td>Correction Factor</td>
<td>1.00</td>
<td>1.12</td>
<td>1.17</td>
<td>1.22</td>
</tr>
</tbody>
</table>

**To Size the Dryer Capacity for Actual Conditions**

\[
\text{Adjusted Capacity} = \text{scfm} \times C_1 \times C_2 \times C_3 \times C_4
\]

To calculate the capacity of a given dryer based on non-standard operating conditions, multiply the standard capacity by the appropriate correction factor(s).

**EXAMPLE:**

- **Dryer Model:** RFC-300
- **Standard Capacity:** 300 scfm
- **Actual Operating Conditions:**
  - 80°F ambient temperature: \( C_1 = 1.05 \)
  - 100°F inlet temperature: \( C_2 = 1.0 \)
  - 125 psig working pressure: \( C_3 = 1.07 \)
  - 38°F required dew point: \( C_4 = 1.0 \)
- **Adjusted Capacity:**
  \[
  \text{Adjusted Capacity} = 300 \text{ scfm} \times 1.05 \times 1.0 \times 1.07 \times 1.0 = 337 \text{ scfm}
  \]

**To Select the Dryer Model for Actual Conditions**

\[
\text{Adjusted Capacity} = \text{scfm} / C_1 / C_2 / C_3 / C_4
\]

To choose a dryer based on a given flow at non-standard operating conditions, divide the given flow by the appropriate correction factor(s).

**EXAMPLE:**

- **Given Flow:** 310 scfm
- **Actual Operating Conditions:**
  - 80°F ambient temperature: \( C_1 = 1.07 \)
  - 90°F inlet temperature: \( C_2 = 1.21 \)
  - 100 psig working pressure: \( C_3 = 1.0 \)
  - Required dew point: 38°F pdp: \( C_4 = 1.0 \)
  
  \[
  \text{Adjusted Capacity} = 310 \text{ scfm} / 1.07 / 1.21 / 1.0 / 1.0 = 230.4 \text{ scfm}
  \]
- **Selected Dryer Model:** RFC-250

Donaldson®
Trust Donaldson Compressed Air & Gas to deliver a complete range of compressed air purification solutions that improve air quality throughout your plant – from the compressor room to all points of use. With over 30 years of expertise in compressed air filtration and separation, Donaldson manufactures a complete line of drying and filtration equipment in an innovative, cutting-edge design with energy efficient operation and reliable performance to increase your productivity and lower your operating cost for the air volume that fits your needs.

Donaldson Compressed Air & Gas offers a wide variety of solutions to reduce your energy costs, improve your productivity, guarantee production quality and help preserve the environment.

**PRODUCTS**

- Activated carbon filters
- Adsorption dryers
- Breathing-air purifiers
- Cartridge filters
- Chillers
- Condensate drains
- Coolers
- Cyclone separators
- Demisters
- Disposable filters
- Elements
- Emulsion separators
- Filters
- Fine filters
- Filter housings
- High-performance filters
- High-pressure filters
- Medical vacuum filters
- Membrane dryers
- Oil/vapor absorbers
- Oil/water separation systems
- Pre-filters
- Pre-separators
- Process filter elements
- Process filter housings
- Pure gas filters
- Refrigeration compressed air dryers
- Silicon-free filters
- Steam filters
- Sterile filters
- Submicro filters
- Systems engineering
- System solutions
- Vacuum filters
- Vent filters

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