

"Dedicated to creative, responsive, quality solutions for those we serve."

## Custom Membrane Pilot Plants

Carollo Engineers' custom membrane pilot plants (CMPPs) provide a unique means of evaluating low-pressure (microfiltration and ultrafiltration) membrane modules operating in a dead-end mode from multiple membrane manufacturers. Carollo designed the CMPPs to accommodate a wide range of pressurized membrane modules.

*Carollo's custom membrane skids offer the following benefits:*

- ▼ Demonstrate performance of full-scale module.
- ▼ Provide multiple module compatibility for custom and standard module design.
- ▼ Offer high degree of automation, requiring little operator labor.
- ▼ Provide flexibility in operating and backwashing conditions.
- ▼ Include a complete remote data acquisition and control (RDAC) system.

Carollo has used the CMPPs in the evaluation of membranes of various surface area, configuration, and flow pattern. The CMPPs are often used to develop design criteria for a range of membrane modules in order to identify the most cost-effective solution. Design criteria in these evaluations include optimization of the permeate flux and the system recovery.

The CMPPs are also used to optimize backwashing procedures to

minimize backwash wastewater production. These investigations include:

- ▼ Backwash chemical dosing strategy.
- ▼ Backwash flow rates and durations (for both air and water).
- ▼ Recovery.

The CMPPs have also been used to evaluate various chemical cleaning strategies. Important considerations with respect to chemical cleaning include the cost of the chemicals and disposal requirements. Chemical cleaning optimizations involve the examination of:

- ▼ Sequence of chemical addition.
- ▼ Chemical dosages.
- ▼ Temperature.
- ▼ Duration of each phase of cleaning.

### Instrumentation

The CMPPs are equipped with remote data acquisition and control (RDAC) systems, which include a programmable logic controller (PLC) and data logging system to monitor operational parameters at user-defined intervals. Critical operating parameters, such as flow rates, flux, transmembrane pressure, and temperature are displayed in real time in a graphical format using a human-machine interface (HMI), or accessed remotely. In addition, water quality data, such as permeate turbidity and particle counts are also continuously measured. All data, control functions, and operating parameters can be monitored or adjusted remotely via a website-based or dial-up connection.

### Sample Collection

For quality assurance and control purposes, pressures, temperatures, and flows can all be manually checked and compared to transmitter readings on the pilot plant. Sample taps located on the pilot plant also provide access to feed, permeate, and backwash water for quantification of water quality parameters. Waste streams from the cleaning process may also be collected for pH adjustment prior to disposal.





Design Criteria		
	Value	Additional Information
Piping	-	Schedule 80 PVC
Nominal Capacity	50 gpm	Feed tank with overflow
<b>Modules</b>		
Type	-	Dead-end processing, multiple manufacturers
Feed and Permeate Connections	3 in	
<b>Production</b>		
Feed Pump Capacity	45 gpm @ 28 psig	Three-phase, 1.5-hp, centrifugal, flooded suction, with VFD
Strainer	130-500 $\mu$ m	In-line, manually cleaned
Flow Control	3-in butterfly valve	Includes integrated position indicator
<b>Backwash</b>		
Backwash Pump Capacity	150 gpm @ 55 psig	Three-phase, 7.5-hp, centrifugal, flooded suction, with VFD
Backwash Water Tank	200 gal	With overflow
Air Scour Pressure Capacity	120 psig	On-board compressor, with pressure regulator
Chemical Dosing Pump Capacity	0.75 gal/hr	Positive displacement
<b>Clean in Place</b>		
Chemical Types	-	Chlorine, caustic, and acid
Pump Capacity	1.25 gal/hr	Three each, peristaltic
Chemical Storage Tanks	10 gals	Three each, polyethylene
Heater	2 kW	Immersion, in-line with cleaning recirculation pump
Recirculation Pump Capacity	10 gpm @ 16 psig	One-phase, 0.2-hp, flooded suction

Technical Specifications	
Skid Weight	1,500 lbs
Skid Dimensions (L x W x H)	64 in x 74 in x 79 in
Electrical Requirements	Three-phase, 480-volt, AC power (40A circuit breaker)
Typical Rental Fee	\$5,000 per month