

Reverse Osmosis/Nanofiltration Demonstration-Scale Pilot Plant

Carollo Engineers' demonstration-scale reverse osmosis (RO) and nanofiltration (NF) pilot plant is designed to simulate full-scale system operation and water quality. The demonstration plant is used to develop full-scale design criteria and operation costs. Membrane replacement frequency, chemical cleaning frequency, and membrane life are also determined through demonstration-scale testing with this equipment. Additionally, this pilot can be used to verify the accuracy of RO models that predict feed pressure and permeate water quality.

The demonstration-scale pilot plant is configured in a 2:1 array with seven 4-inch-diameter elements per pressure vessel. This configuration can be used to simulate the operating conditions for brackish water treatment and membrane softening applications at a product water recovery of up to 85 percent. The pilot system is equipped with a programmable logic controller (PLC) system capable of controlling feed water pH, total permeate water flow, and permeate flow balance between stages. Flow balance can be controlled by either an inter-stage booster pump or by throttling permeate pressure

in the first stage. The system is also equipped with a data acquisition system that logs pertinent data automatically and is accessible by remote telemetry.

Feed water is delivered through a low head booster pump and then a cartridge filter. Pretreatment chemicals (i.e., acid and scale inhibitor) are then added. A static mixer blends the pretreatment

chemicals and feeds the water to a high-pressure RO pump. High-pressure RO feed water passes through

the RO membrane array while gauges and sensors monitor various parameters at critical locations. Flow is metered at the following process locations: first-stage permeate, system permeate, and concentrate. A sample tap panel is provided to gather water samples from all points throughout the process. Manual flow measurements can also be taken from every pressure vessel and at points where flow is metered electronically to verify meter calibration.



An operations and maintenance (O&M) manual and a standard operating procedures (SOP) manual are included with the unit. Spreadsheets are also available to generate report-quality graphics, and facilitate data analysis and interpretation.



Carollo's demonstration-scale RO/NF pilot plant offers the following benefits:

- ▼ Mimics full-scale conditions.
- ▼ Offers the only way to accurately determine cleaning frequency, membrane life, and permeate water quality.
- ▼ Includes state-of-the-art PLC and data acquisition system to minimize operator time and maximize data production.

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Design Criteria		
	Value	Additional Information
Design Flow	30 gpm	
RO Booster Pump Suction Side Pressure Required	50 psi	
Chemical Feed		
Scale Inhibitor Pump Capacity	0.42 gph	LMI model no. A971-352SI series A3
Scale Inhibitor Tank	15 gal	
Acid Pump Capacity	0.42 gph	LMI model no. P131-392SI series A9
Cartridge Filter Criteria		
Length	20 in	
Type	-	Glass fiber wound or polypropylene
Membrane Vessels		
Number of Vessels	6	Three each — codeline 40A30-4, Three each — codeline 40A30-3
Permeate End Adapters	-	Membrane type to codeline 40A30 end caps, to be ordered with test membranes.
Array Configuration		
Array	2:2:1:1	
Elements in Stage 1	up to 14	
Elements in Stage 2	up to 7	
Membrane Element		
Length	40 in	
Diameter	4 in	

Technical Specifications	
Skid Weight	2,000 lbs
Skid Dimensions (L x W x H)	180 in x 48 in x 60 in
Electrical Requirements	Three-phase, 60A, 480-volt
Feed Flow Connection	2-inch FNPT
Permeate Drain, By-product Drain Connection	1-inch FNPT
Well to Waste Drain Connection	2-inch FNPT
Typical Rental Fee	\$5,000 per month