

MSR

A pilot plant designed for process development, membranes scale up testing, quality assurance and small-scale/production range within nanofiltration or reverse osmosis phase.

Multi-Stage Recycle (MSR) unit consists of two stages with each stage fitted with 3 modules and a heat exchanger. Also equipped with: CAT HP feed pump, Fristam recirculation pumps with VSD, pressure & temperature sensors, flowmeters, control panel and a hold-up volume of circa 320 Liters. All mounted on a framework fabricated from a high-grade stainless-steel material.



Application Range

Nanofiltration (NF)	Reverse Osmosis (RO)
18 – 22 L/min	18 – 22 L/min

Electrical Power Supply	Connections
400 Volts	Inlet to feed pump: 1 1/2" hose tail
3-phase (5 pins)	HE in/out cooling water: 3/4" OD DN 20 hose connector
50 Hz. 70 - 100 Amp	Permeate outlet, concentrate outlet, tube-side & Shroud-side CIP return: 1" OD DN25 hose tail
Motor rating: 35 KW (feed pump @ 5 KW, recirculation pumps @ 30 KW)	

Size & Weight

Dimension			Unit & Package	Unit Only
Length	Height	Width		
412 cm	222 cm	120 cm	1650 kg	1500 kg

Framework

Welded stainless-steel frame fabricated from a high-grade 304 SS for corrosion resistance, high rigidity and temperature resistance.

The modules on the MSR Plant are designed with series flow end caps; connecting all 18 tubes in series. and all Modules together in series. The modules are fed in parallel. There are 2 stages of 3 modules fed in parallel.

Module

6 x 12 ft (3.6 m)

B1 Module (3 modules per stage)

Each Module has the following major components: A "Shroud", a "Tube-Nest", which is made up of 18 perforated stainless-steel tubes and "End Caps". Each of the 18 tubes are fitted with membranes.

Specification per module:

- Membrane area: 2.6 m²
- Module weight: 33.7 kg
- Hold-up volume: Tube-side 8.4 L
Shroud-side 20 L
- Membrane tube ID: 12.7 mm
- Total membrane area modules: 15.6 m²

Heat Exchanger (HE)

2 x 12 ft (3.6 m) Shell & tube type heat exchanger

Process fluid is piped from the outlet of each recirculation pump through all 18 tubes in series within the heat exchanger, while cooling water passes at low pressure (1-3 bar) through the shroud (shell) side. Cooling media flow could be up to 25 L/min/stage (up to 50 L/min for both stages).

Plant mechanical operating limit

- Max operating pressure: up to 64 bar
- Max pressure drop: 10 bar
- Max operating temperature: up to 80°C

MSR

A pilot plant designed for process development, membranes scale up testing, quality assurance and small-scale/production range within nanofiltration or reverse osmosis phase.

Multi-Stage Recycle (MSR) unit consists of two stages with each stage fitted with 3 modules and a heat exchanger. Also equipped with: CAT HP feed pump, Fristam recirculation pumps with VSD, pressure & temperature sensors, flowmeters, control panel and a hold-up volume of circa 320 Liters. All mounted on a framework fabricated from a high-grade stainless-steel material.



Pumps, IEC Motors & VSD

- Feed Pump: CAT HP 7CP6171 pump. 2.4 m³/hr max flow, 5 KW motor, 60 bar max pressure.
- Recirculation Pumps X2: Fristam centrifugal FPH 752/250 VA pump. 6 m³/hr max flow, 15 KW motor, 10 bar max pressure.
- Flows from both feed and recirculation pumps can be adjusted via the HMI screen.

Flowmeter

- 4 independent Siemens electromagnetic flowmeters are installed on the unit: on the feed, retentate and on both recirculation lines. 2 independent IFM electromagnetic flowmeter are also installed on both permeate lines.

Pressure & Temperature Sensor. Pressure Control Valve

- The unit is equipped with an automated back pressure valve installed on the retentate line to create the back pressure; this can be controlled or adjusted via the HMI screen.
- A diaphragm valve is also installed on the low-pressure side of the retentate line to control flow.
- The unit is fitted with a pressure relief valve set at 70 bar for NF/RO.

Pneumatic/Electric Actuator

- 3 independent actuators are installed on the back-pressure loop, retentate line and permeate line. Flow direction can be adjusted via HMI screen.

Pulsation Damper

- A pulsation damper or accumulator is fitted to the pump outlet.
- This should be charged with Nitrogen @ 40 bar for NF/RO.

Safety

- The unit is designed to the principles of Supply of Machinery (Safety) Regulations 1992 and are safe if operated in accordance with the procedures in the operating manual.