EnviroSep
FLUID & HEAT RECOVERY SYSTEMS
A DIVISION OF TMT, INC.

Boiler Make-up Water Reverse Osmosis System

Model BMURO

The Model **BMURO**, Boiler Make-up Water Reverse Osmosis System is a fully integrated system which is designed and manufactured to remove up to 99% of the contaminants and impurities (**Alkalinity & Conductivity**)from the Boiler Make-up Water prior to the Make-up Water blending with Condensate Return. By physical treatment of the Make-up Water to Reverse Osmosis (RO) quality, ***fuel costs and boiler operating costs are significantly reduced*** by the reduction of Boiler Blowdown Rate. Reduction in energy consumption is normally expected to be the most ***significant savings***; however, boiler chemical treatment cost reduction can in some cases be as high as fuel savings. Each ***EnviroSep*** Model **BMURO** system is custom designed and manufactured to meet specific site requirements. All controls are fully integrated into the system via UL-Listed, single-point power connection Industrial Control. All systems are fabricated and welded per ASME Section IX Code and Standards, and are Hydrostatically tested prior to shipment.

SIZING AND SELECTION

Units are custom engineered for individual systems, based upon the selection of the system parameters:

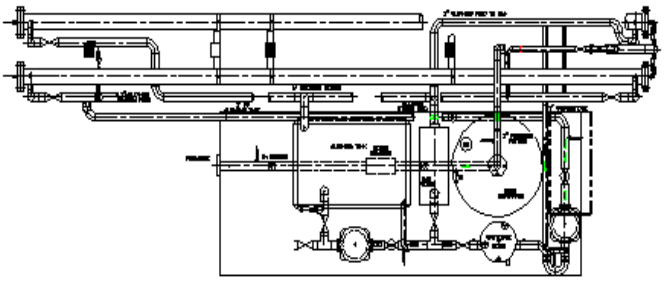
I. System Flow Rate: Range of 5 gpm to 2,000 gpm

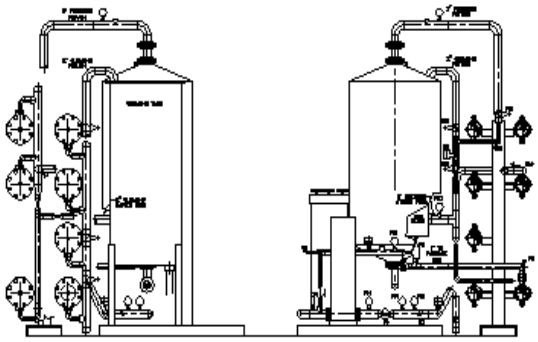
II. Inlet Temperature: Range of 40°F to 100°F

III. Outlet Temperature: Range of 70°F to 105°F

IV. System Pressure: Range of 50 psig to 350 psig

V. Dimensions: Based on specific requirements





Legend:

A. System Inlet Bag Filtration or Back-washing Strainer

B. System Feed Pump

C. RO Membrane Housings and Membrane Cartridges

D. System Feed and Permeate Flowmeters

E. System Pressure Gauges

F. UL-Listed Industrial Control Panel

G. High Pressure and Low Flow Safety switches

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STANDARD CONSTRUCTION

- Fabricated Floor-mount Steel Base and Frame
- Stainless Steel or FRP Membrane Housings
- Stainless Steel Piping & Valving
- Cast Iron Pilot-operated Temperature Control Valve with 8ft. capillary tube connected to Temperature Sensor
- Steam-powered Condensate Pump
- Motive Steam Connection with Drip Leg Station
- Pump Exhaust pre-installed
- Hydrostatically Tested
- High Temperature Industrial Enamel Paint

CONDITIONS OF OPERATION

Max. Allowable Pressure:	125 psig / 8.6 bar
Max. Allowable Temperature:	375 ^{o}F / 190.5 ^{o}C

Note: Condensate back pressure is assumed at 0 psig unless otherwise specified.

EXAMPLES OF TYPICAL SAVINGS

I. System Steam Pressure : 30 psig

Make-up Water-side Flow rate: 15.1gpm

Water side flow rate based on 80 ^{o}F temperature change from 60 ^{o}F to 140 ^{o}F.

Based on continuous system operation of 8400 hr./yr., approximate energy savings are **5100 Million Btu per year**. At an estimated steam cost of $5.00 / MM Btu, potential yearly savings are **$25,270.00**

II. System Steam Pressure : 100 psig

Make Water side Flow rate: 45.1gpm

Water side flow rate based on 80 ^{o}F temperature change from 60 ^{o}F to 140 ^{o}F.

Based on continuous system operation of 8400 hr./yr., approximate energy savings are **15,171 Million Btu per year**. At an estimated steam cost of $5.00 / MM Btu, potential yearly savings are **$75,858.00**

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Boiler Make-up Water
Reverse Osmosis System
Cost Justification

A. Steam Flow Rate = _____ lbs/hr

B. Condensate Return (% of Total) = _____ %

C. Condensate Return TDS = _____ µmhos/cm

D. Make-up Water (% of Total) = _____ %

E. Make-up Water TDS = _____ µmhos/cm

F. Required Boiler Conductivity = _____ µmhos/cm
(normal range 2,500 to 2,800 µmhos/cm)

G. Fuel Cost = _____ $/klbs of steam

H. Water / Wastewater Cost = _____ $/Mgal

M. M = (BxC) + (DxE) = _____ µmhos/cm

N. N = M/F = _____ %

P. P = (BxC) + (DxEx0.04) = _____ µmhos/cm

Q. Q = P/F = _____ %

R. R = (((N-Q)xA) / 1,000) x G = _____ $/hr Fuel Savings

S. S = R x 8,736 = _____ **$/yr Annual Fuel Savings**

I. V = (((N-Q) x A) / 8,341) x H = _____ $/hr Water savings

W. W = V x 8,736 = _____ **$/yr Annual Water Savings**

T. T = W + S = _____ **$/yr Total Savings**

Note: Boiler Chemical savings are in addition to the above savings however, vary depending chemicals used.

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Boiler Make-up Water
Reverse Osmosis System
Case Study

A 30,000 lb/hr steam system had a Boiler Blowdown rate of 6% and Make-up Conductivity was 600 µmhos/cm. Make-up Alkalinity was 320 mg/l. Condensate Return was 60%, therefore, feedwater Conductivity was 240 µmhos/cm. By installation of the Model **BMURO** system, the Make-up Water to the Boiler system was improved to 30 µmhos/cm Conductivity. The resulting Boiler Blowdown rate was reduced to 0.3% while maintaining a Boiler Water Conductivity of 3,200 µmhos/cm. The below listed savings were achieved by the decrease in Boiler Blowdown rate.

Annual Fuel Savings ($7.00/MMBTU) = $ 33,506

Annual Water / Wastewater Savings ($3.00/Mgal) = $ 5,166

TOTAL ANNUAL SAVINGS = $ 38,672

Note: Boiler Chemical Savings are in addition to the above savings.

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