

MECHANICAL VAPOR FOR RECOMPRESSION



EVAPORATION REQUIREMENTS

OF

CHROMATOGRAPHIC SEPARATOR  
BY-PRODUCT STREAMS

ABSTRACT: MECHANICAL VAPOR RECOMPRESSION

Presentation Summary

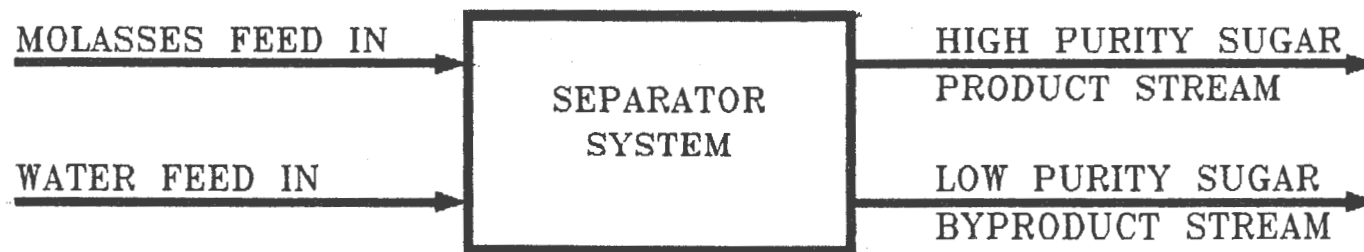
Chromatographic Separators are being installed all over the world. One disadvantage of the increased sugar extraction gained from the separators is the dilution to the product and byproduct streams. This presents an increased evaporation load onto existing factories and equipment.

This presentation reviews the principles of Mechanical Vapor Recompression. Approximate installation paybacks are discussed as well as a material & energy balance on the existing Twin Falls Raffinate vapor recompression system.

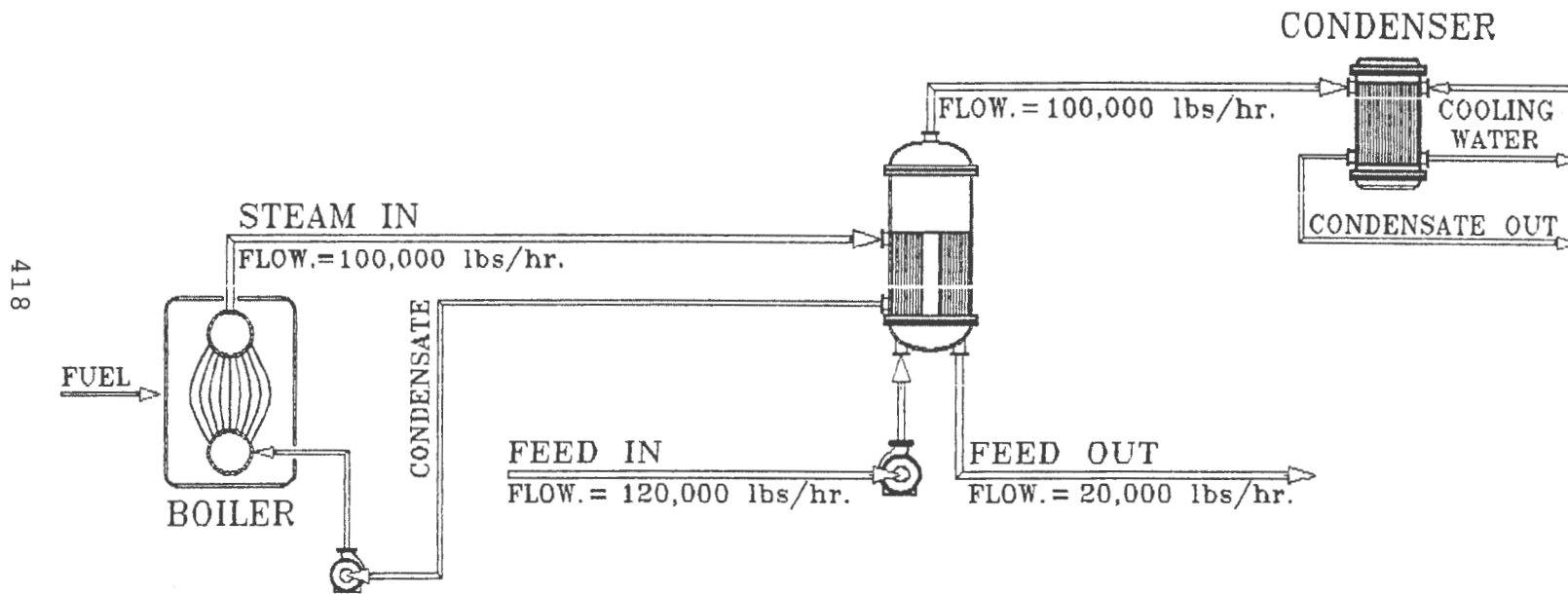
# CHROMATOGRAPHIC MOLASSES SEPARATOR

## BLOCK DIAGRAM

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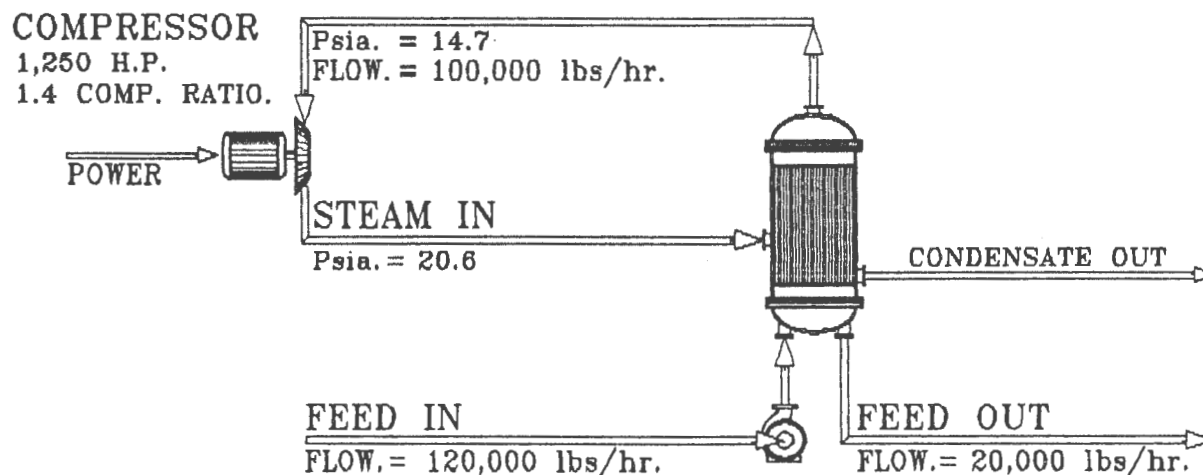


# SINGLE EFFECT EVAPORATION WITH CONDENSER



ENERGY DEMAND :  $100,000 \text{ lbs/hr.} \times 1,000 \text{ BTU/lb} = 100,000,000 \text{ BTU/hr.}$

# SINGLE EFFECT EVAPORATION WITH MECH. VAPOR RECOMPRESSION

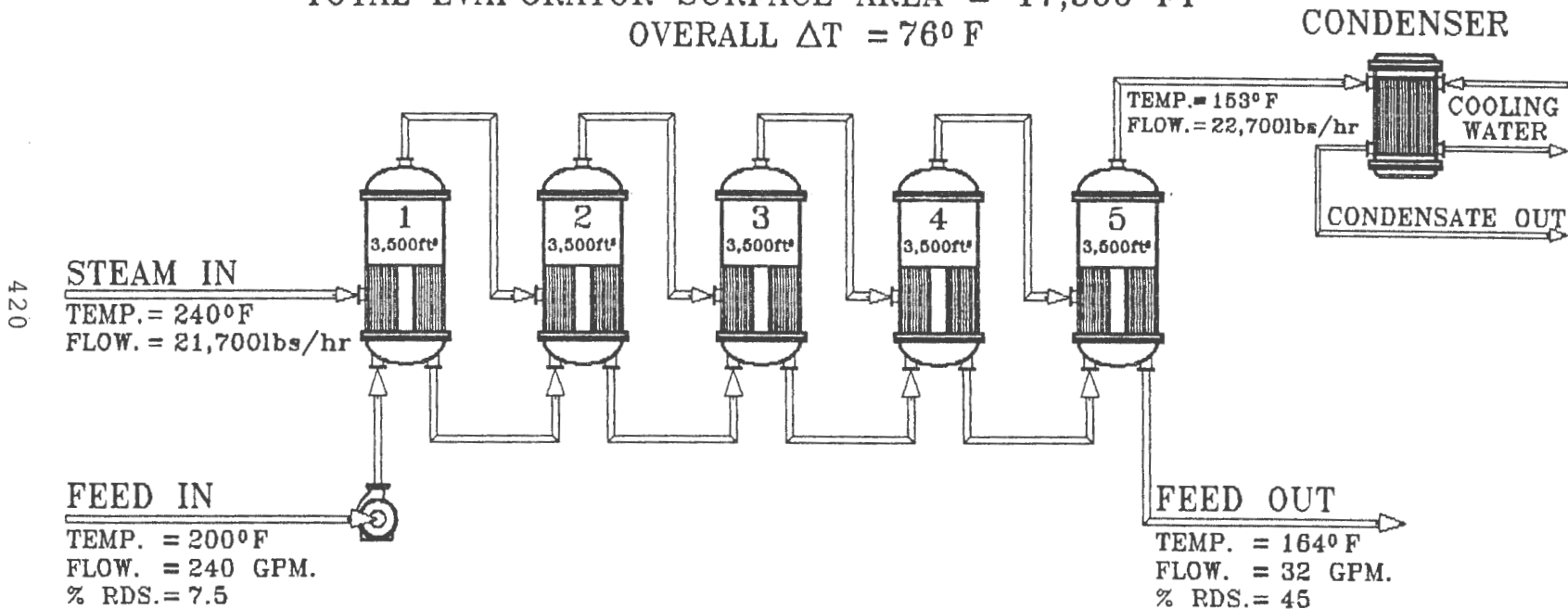


ENERGY DEMAND : 100,000 lbs/hr. x 31.4 BTU/lb. = 3,140,000 BTU/hr.

ENERGY SAVINGS :  $\frac{100,000,000 - 3,140,000 \text{ BTU/hr.}}{100,000,000 \text{ BTU/hr.}} \times 100 = \boxed{97\%}$

# CONVENTIONAL MULTI-EFFECT EVAPORATION

TOTAL EVAPORATOR SURFACE AREA = 17,500 FT<sup>2</sup>  
OVERALL  $\Delta T = 76^{\circ} F$

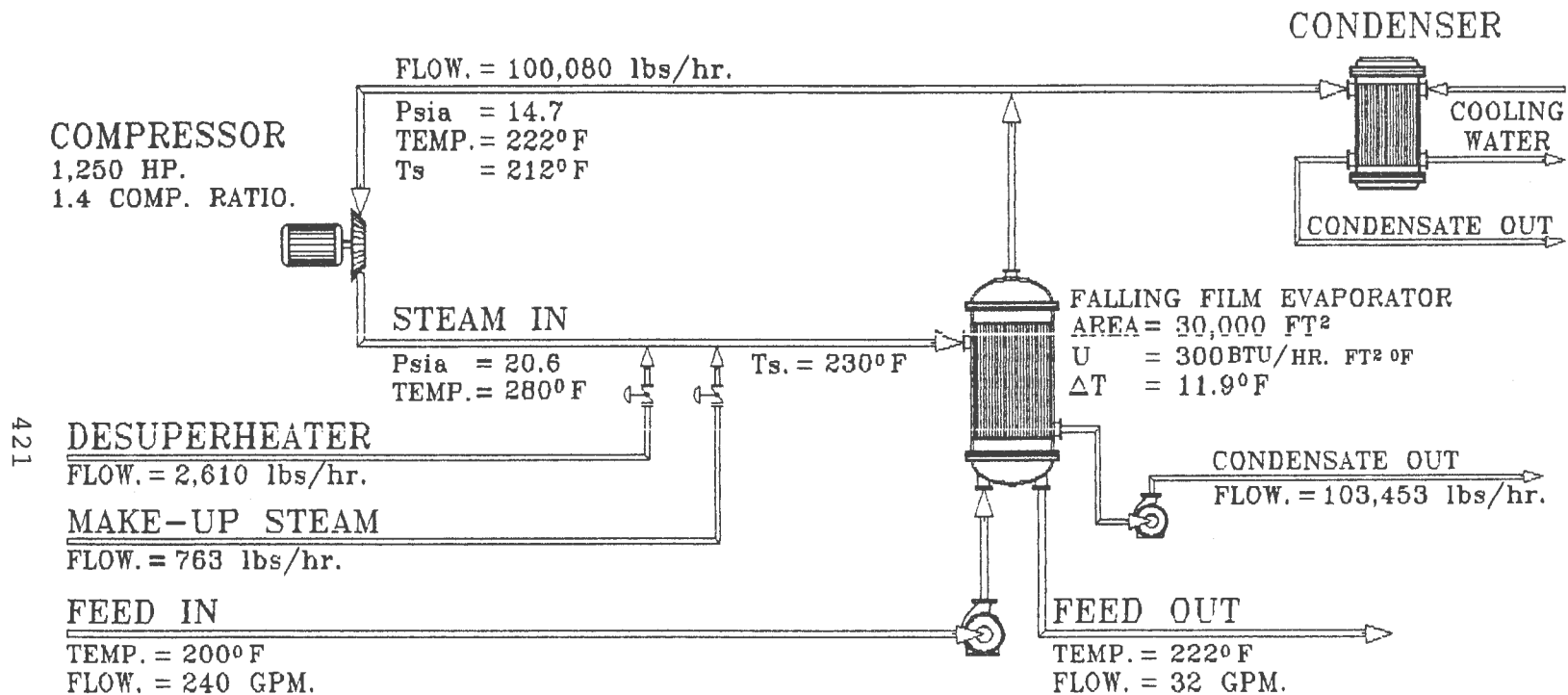


## ENERGY ANALYSIS

330 DAY ENERGY COST @ STEAM \$250 / 1,000 lbs = \$430,000

CAPITAL COST = \$1,492,000

# MECHANICAL VAPOR RECOMPRESSION



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## ENERGY ANALYSIS

330 DAY ENERGY COST = ELECTRICAL 2.5¢/kw hr. = \$185,000  
 MAKE-UP STEAM @ \$2<sup>50</sup> /1,000 lbs = \$15,000  
 CAPITAL COST = \$2,805,000

# RETURN ON INVESTMENT

EQUIPMENT	CAPITAL COST	OPERATING COST (330 DAYS)
MECHANICAL VAPOR RECOMPRESSION	\$ 2,805,000	\$ 200,000
QUINTUPLE EFFECT EVAPORATOR	\$ 1,492,000	\$ 430,000
DIFFERENCE	<u>\$ 1,313,000</u>	<u>\$ 230,000</u>

$$\text{RETURN} = \frac{\$ 1,313,000}{\$ 230,000/\text{year}} = 5.7 \text{ years.}$$



# RETURN ON INVESTMENT

EQUIPMENT	CAPITAL COST	OPERATING COST (330 DAYS)
MECHANICAL VAPOR RECOMPRESSION	\$ 2,805,000	\$ 200,000
QUINTUPLE EFFECT EVAPORATOR WITH BOILER & COOLING TOWER	\$ 2,026,000	\$ 467,000
DIFFERENCE	<u>\$ 779,000</u>	<u>\$ 267,000</u>

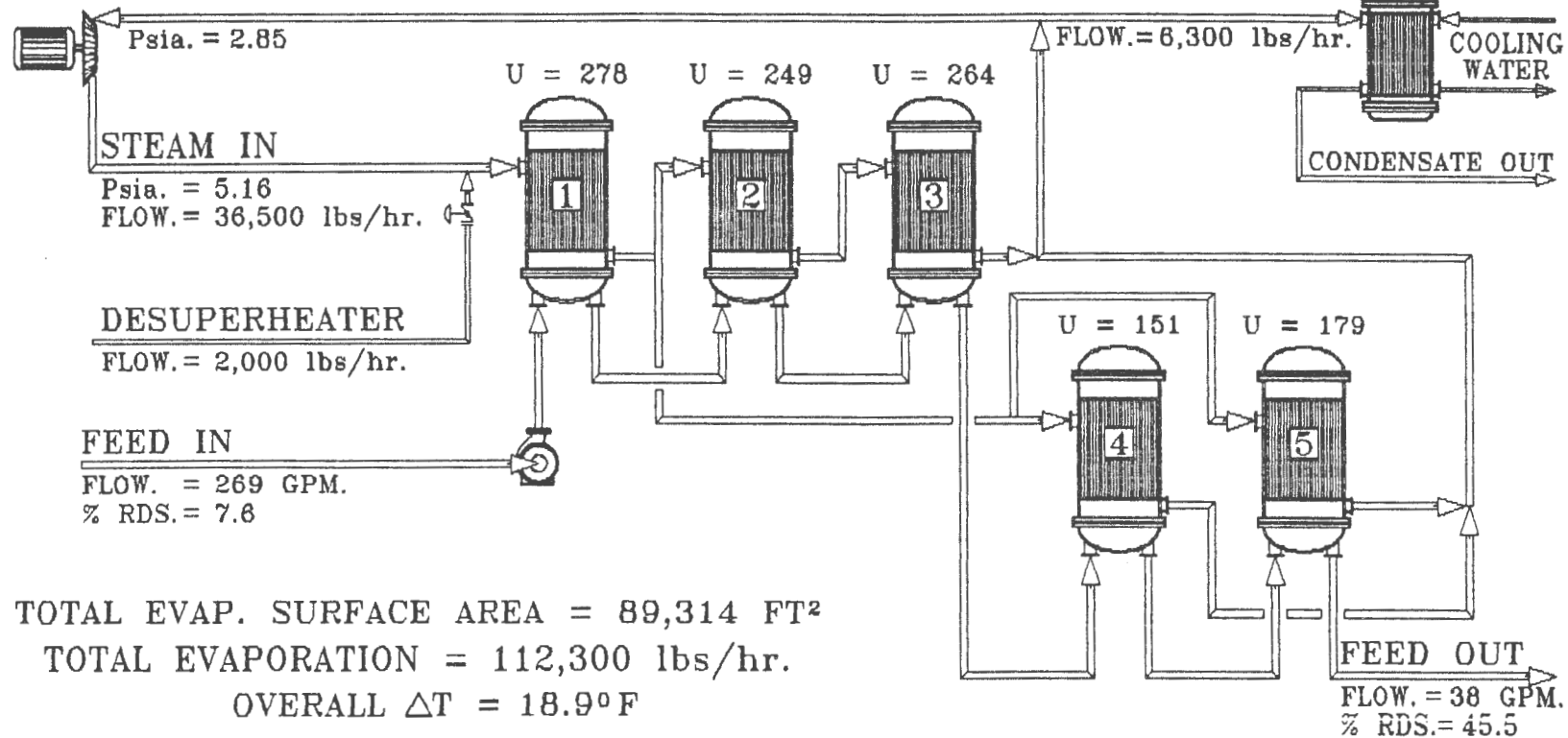
$$\text{RETURN} = \frac{\$ 779,000}{\$ 267,000/\text{year}} = 2.9 \text{ years.}$$

# TWIN FALLS RAFFINATE

## MECH. VAPOR RECOMPRESSION SYSTEM

**COMPRESSOR**  
 970 H.P.  
 1.8 COMP. RATIO

**CONDENSER**



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TOTAL EVAP. SURFACE AREA = 89,314 FT<sup>2</sup>  
 TOTAL EVAPORATION = 112,300 lbs/hr.  
 OVERALL  $\Delta T = 18.9^\circ F$