PECTINA de MEXICO
MEXICO

DAE 11/1/76
W.O. 10300

Operating Instructions
For
APV Quadruple Effect, Six Stage Falling Film Evaporator

Operators must read and understand these instructions. Before you turn a valve, push a button, or adjust an instrument, make sure you know what will happen.

All pumps must be primed with water and pump seal water valves opened prior to all rotational check or operation.

Operating temperatures and pressures contained herein are to be used only on initial start-up. Field tests will verify operating conditions. Sequential operation may be changed.

I. General:

The APV Quadruple Effect, Six Stage Evaporator concentrates liquor by employing the "falling film" principle for performing the evaporation. Evaporation takes place by heating the liquor as it falls freely between gasketed rectangular plates, and then passing the heated liquor into a separator that is maintained at a relatively high vacuum (ie 26"-28" Hg. vacuum). Heating is performed by transferring heat through the plates by condensing steam on the opposite side of the plates. The plates are arranged in "Plate Units", each plate unit consists of two (2) plates, thereby allowing an annular steam passage on each side of the annular liquor passage. Because of gasket location, liquor cannot intermix with steam and vice versa. Evaporation duties may easily be altered by adding or subtracting "Plate Units" thereby creating an inherent flexible APV System. Further, heating surfaces may easily be observed simply by opening the "Plate Pack".

II. Major Components:

1. 1st Effect: Frame Size 3:1, 53 PU's* w/60" diameter reversed dish snail shell separator.

2. 2nd Effect: Frame Size 1:2, 28 PU's* w/36" diameter reversed dish snail shell separator.

3. 3rd Effect: 3A Stage and 3B Stage in series flow w/common frame and separator as follows: Frame Size 2:2, 44 PU's* w/48" diameter reversed dish snail shell separator.

4. 4th Effect: 4A Stage and 4B Stage in series flow w/common frame and separator as follows: Frame Size 3:1, 51 PU's* w/60" diameter reversed dish snail shell separator.

* PU's means Plate Units. Each plate unit consisting of 2 plates.

5. One (1) R56 APV Pre-Heater Plate Heat Exchanger.

6. One (1) R56 APV Regen/Cooler Plate Heat Exchanger.

7. One (1) R56 APV Cooler (Separate).

8. One (1) Feed Balance Tank.

9. One (1) Thermo-compressor, S/S.

10. One (1) Low Level Barometric Condenser, C/S. Direct Contact

11. One (1) Two Stage Steam Ejector System w/~~Surface Inter-~~ inter-condenser.

12. Necessary pumps, piping, vapor ducts, etc., required for a complete package citrus pectin evaporator.

13. Necessary pneumatic instruments and in situ thermometers and pressure gauges required for efficient operation.

III. Specifications

1.	Feed Medium	Citrus Pectin
2.	Feed Rate	48,000 lbs/hr
3.	Feed Concentration	0.6% Total Solids
4.	Feed Temperature	130°F / 54.4°
5.	Feed Temperature to Evaporator	190°F / 88°
6.	Product Rate	12,000 lbs/hr
7.	Product Concentration	2.4% Total Solids
8.	Product Temperature	82°F / 26.7°
9.	Evaporation Rate	36,000 lbs/hr

Reference: Schematic Quadruple Citrus Pectin Evaporator for Pectina de Mexico PE4-5345 Rev. A

IV. Operating Design:

The present design utilizes a constant steam flow to the evaporator steam header (via the thermocompressor) to do the evaporating and manually varying the feed rate in order to maintain product specifications. Thus, with a constant steam flow, an increase in feed rate will lower or decrease product total solids and vice versa. A manually adjusted control valve is used for varying the feed rate.

The feed flow through the evaporator, however, is a so-called "Mixed" (ie, 1, 2, 4, 3) flow when compared to the straight "Forward" or "Backward" flow through an evaporator. This flow enables a somewhat higher temperature to be used where the vacuum is higher and alleviates some viscosity problems that might be encountered in the other types of flow.

V. Instrumentation:

A. Thermocompressor Steam Pressure Controller

A constant steam flow to the evaporator is maintained by employing a Spence Type EA Series Regulator and a pneumatically operated steam control valve ahead of the thermocompressor. Manual adjustment of the pneumatic signal being sent to the control valve is required for setting the steam flow (via steam pressure) to the steam header. The Spence regulator is located ahead of the control valve for maintaining a constant steam pressure. An initial adjustment of the regulator is required.

B. Feed Rate Control

The feed rate to the evaporator is controlled by manually adjusting an APV Graduated Control Valve (GCV). The control valve is built like a mechanics micrometer and can be set accordingly.

C. Feed Pre-Heat Control

Temperature of the feed liquor flowing to the 1st Effect from the feed balance tank is controlled by manually adjusting two (2) 4" Demco vapor control valves, namely, (1) is by controlling the vapor flow from the 1st Effect vapor duct and (2) the vapor flow from the 1st Effect steam header. An initial pre-heating of feed liquor in the same R56 preheater is done by using hot condensate from the 1st and 2nd Effect units.

D. System Vacuum

A two (2) stage ejector system with a surface intercondenser is used to provide the required vacuum for evaporation. No adjustment is required except to periodically clean the steam strainers (by customer) located ahead of the ejector. Further, the steam pressure must be maintained at 110 PSIG.

E. System Vacuum Control

The evaporator system vacuum is maintained constant by employing an autonomous Fisher 630 R vacuum relief valve. This valve is connected to the vapor line connecting the condenser to the vacuum system. Since the vacuum produced by the vacuum system pulls more than is desired, the Fisher vacuum control valve opens and allows atmospheric air to enter the system in order to obtain the desired vacuum. (Initially, this valve will have to be adjusted for obtaining 26.5-27.0" Hg. (ie the equivalent boiling point is 120-115°F.) 673.1 – 685.8 mm.

168 - 46.1 °C